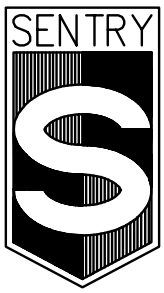


Sample Sequencer™

Installation, Operation and Maintenance Manual

SPD 5.5.5
Rev. 9
2/00

Web: www.sentry-equip.com
e-mail: sales@sentry-equip.com

TABLE OF CONTENTS

	Page
GENERAL SPECIFICATIONS	5
Specification for Valve Output Board	6
Specification for Signal Switching Output Board	6
Specification for 0-1 Volt DC Output Board	7
Specification for Remote Electronic Track & Hold Board	7
Specification for Plug-In Track & Hold Board	8
SAFETY PRECAUTIONS	10
GENERAL DESCRIPTION	11
Modes of Operation	11
Output Boards and CRT Display	15
Optional Manifolded Sampling Valve	16
OPERATION	17
Description of Controls	17
I/O Board DIP Switches	19
Membrane Switch Keys	21
Programming	21
Display Functions	23
Operating Modes	25
Off	25
Cycle	25
Batch	28
Turning Sample Streams On & Off	29
Advancing Streams	30
Holding on One Sample Point	30
Alarms	30
Sample Nametag	32
INSTALLATION	33
Unpacking	33
Mounting	33
Power and Ground Connection	37
I/O board Connections and Settings	38
Sample Valve Electrical Connection to Valve Output Board	38
Sample Valve Piping	40
Recorder Signal Connections	40
Signal Switching Output Board (P/N 6-02499C)	42
O-1 Volt Signal Switching Output Board	44
Remote Electronic Track & Hold Boards (P/N 7-00839A)	46
Plug-In Track & Hold Board (P/N 6-02499E)	47
Alarm Signal Connections	48
Starting Up the Sample Sequencer	49
MAINTENANCE	50
Fuses	50

TABLE OF CONTENTS

Page

Calibration....50
Analog Output Calibration of the Remote Electronic Track & Hold Board (7-00839A)....51
Analog Output Calibration of the Plug-in Electronic Track & Hold Board (P/N 6-02499E)....51
TROUBLESHOOTING....53
COMPUTER COMMUNICATIONS....55
SEQUENCE Monitor Program....55
Communication Protocol....56
SERVICE....57
SPARE PARTS LIST....58
ACCESSORIES....59
WARRANTY....60

APPENDIX A: Configuring Sample Sequencer to Output 6 Volt DC on Alarm Contacts of Signal Switching Output Board....63
APPENDIX B: Recommended Piping for Sample Sequencer....64
APPENDIX C: Procedure to Configure Remote Electronic Track & Hold Board for 220/240 VAC Operation....65
APPENDIX D: Instructions to Operate a Hach Series 5000 Analyzer with a Sample Sequencer....66
APPENDIX E: Sample Sequencer Basic Electrical Wiring Diagram....73
APPENDIX F: Plug-In Track & Hold Dual Point Configuration....74
APPENDIX G: Retrofitting a Plug-In (Internal) Track & Hold Board in the Field....77
APPENDIX H: Procedure to Configure Remote Track & Hold Card for Voltage Input....79

List of Figures

		Page
Figure 1:	Sample Sequencer System with Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications	12
Figure 2:	Sample Sequencer with Remote Electronic Track & Hold Board, Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications	12
Figure 3:	Batch Mode Sample Sequencer System with Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications	13
Figure 4:	Sample Sequencer System For Sensor Switching	13
Figure 5:	Sample Sequencer with Plug-In Electronic Track & Hold Board, Manifolded Sample	14
Figure 6:	Sample Sequencer Membrane Switch	18
Figure 7:	I/O Board Arrangement	20
Figure 8:	Cycle Mode Timing Diagram	27
Figure 9:	Batch Mode Timing Diagram (for Batch-Type Analyzers)	28
Figure 10:	Sample Nametag	32
Figure 11:	Panel Mounting & Overall Dimensions, Sample Sequencer	34
Figure 12:	NEMA 4X Rear Cover & Surface Mounting, Sample Sequencer	35
Figure 13:	Enclosure Overall Dimensions, Remote Track & Hold	35
Figure 14:	Remote Valve Board Enclosure	36
Figure 15:	I/O Board Connections	37
Figure 16:	Solenoid Sample Valve Connections	39
Figure 17:	Sample Sequencer Assembly (Rear View)	40
Figure 18:	Sample Sequencer Assembly with Plug-In Track & Hold	41
Figure 19:	Recorder Connections: Signal Switching Using Signal Switching Output Board	42
Figure 20:	Recorder Connections: Contact Closure Channel Indication Using Signal Switching Output Board	43
Figure 21:	Recorder Connections for One or More Analyzers Using 0-1 VDC Output Relay Board	44
Figure 22:	Recorder Connections Using Remote Track & Hold Output Board(s) & Signal Switching Output Board	46
Figure 23:	Recorder Connections Using Plug-In Track & Hold Output Board(s)	47
Figure 24:	Alarm Connections	48
Figure B1:	Recommended Sample Conditioning for Switching Streams to an Analyzer	64
Figure C1:	Remote Electronic Output Board Arrangement	65
Figure D1:	Wiring to Hach Series 5000 Analyzer, Models 60000 - 60004	69
Figure D2:	Recommended Sample Conditioning for Switching Streams to a Hach 5000 Analyzer	70
Figure D3:	Electrical Transmittal Sample Sequencer & Manifold valves	71
Figure D4:	Valve Transmittal Sample Sequencer & Manifold Valves	72
Figure E1:	Sample Sequencer Basic Electrical Wiring Diagram	73
Figure F1:	Component View	74
Figure F2:	Wiring Diagram - Dual Outputs from Plug-In Track Hold Board	76
Figure H1:	Remote T/H Board, Configuration for Voltage Input	79

List of Tables

Page

Table 1: Control and Display Descriptions 17
Table 2: I/O Board DIP Switch (SW1) Functions 19

Sample Sequencer models which have internal track and hold have passed applicable tests for the European Community 89/336EEC EMC Directive. The product is marked and shipped with a Declaration of Conformity. Contact Sentry Equipment with further questions.

GENERAL SPECIFICATIONS*

Applications: The Sample Sequencer is designed to support sample stream switching in the batch or cycle modes. The Sample Sequencer can also switch sensor signals.

Design: Microprocessor-based with non-volatile memory and RS-485 communications

Maximum Number of Samples: 8

Power: 108-132/216-264 Vac, 47-63 Hz, Usage = 3.8VA without Plug-In Track & Hold (Uses external UL/CSA or TUV-approved 6 VDC power supply.) Maximum 14VA with Plug-In Track & Hold.

Inputs from Analyzer:

- One analog input: 0-20 mA or 4-20 mA
- One digital input (dry contact closure) for indications of end-of-analysis signal for batch mode operation
- One digital input (dry contact closure) for analyzer system alarm indication. This signal shuts off Sample Sequencer and valves.

Outputs:

Standard Outputs:

- RS-485 serial communication port (for networking any RS-485 units to a PC)
- Valve Output Board to control maximum eight solenoid valves (DC or maximum 250 Vac solenoids) for sample stream switching
- Plug-in Signal Switching Output Board with eight DPDT relays for analog signal switching or contact closure for point number indication. The second pole of each point relay is used for low voltage commutated analog alarm and analyzer system alarm indication for each point.

Optional Input & Output Boards:

- Plug-in 0-1VDC Output Board with eight DPDT relays for 0-1 VDC output of sample point number. The second pole of each point relay is used for low voltage commutated analog alarm and analyzer system alarm indication for each point.
- Remote Electronic Track & Hold Board to output and hold analog signals (track & hold) of four points. Two analog output boards may be used to provide eight total channels of analog output. Use the remote electronic track & hold boards in combination with one Plug-in Signal Switching Output Board.
- Remote Cell Switching Board to switch maximum eight cells
- Plug-In Track & Hold Board to output and hold four analog signals per circuit board. A maximum of two plug-in Track & Hold boards may be installed in Sample Sequencer enclosure. Use of two Plug-In Track & Hold boards requires that the valve circuit board be mounted remote from Sample Sequencer.

Note: If you are retrofitting a Plug-In Track & Hold to an existing Sequencer in the field, see Appendix G.

Accuracy of Sequencer: +/- 0.1% full scale, standard unit
+/- 0.2% full scale, with Internal Track & Hold Boards

User Interfaces: Integral membrane switch keypad and IBM compatible PC with serial port

* Sentry reserves the right to revise specifications at any time.

Display: Red alphanumeric LED read-out display of channel number, time, alarms, analog signal and station number. Eight red LEDs for point number indication and alarm annunciation. Removable sample name tag.

Case: Material: Noryl; NEMA-4X on face-plate with NEMA 12 rear cover. Option: NEMA 4X backplate for surface mounting. 5.35" x 5.35" x 6.26" deep.

Mounting: Panel or surface mount.

Ambient Temperature: 0-60C; RH 90% max. non-condensing at 40 C max.

Shipping Weight: 5 lbs (2.3 Kg)

Specification for Valve Output Board

Purpose: The valve output board controls contacts which supply power to solenoid valves.

Inputs: Logic-level signals from Sample Sequencer

Number of Points: 8

Relays: DPDT sealed relays, contacts rated for 250 VAC, 220VDC maximum operating voltage. Maximum switching capacity 30W, 62.5 VA for inductive loads.

Point number indication: Nine red LEDs on circuit board with point number silkscreened on board. One LED is for Off status and eight LEDs are for point number indication.

Enclosure (optional for remote mounting): NEMA 4X , IEC 529, IP 67 with knockouts.

Specification for Signal Switching Output Board

Purpose: The output relay board is used to switch analyzer 0-20 mA or 4-20 mA signals provide dry contact sample point number indication. The board includes alarm contacts for normally-open commutated alarm indication.

Inputs: 0-20 mA or 4-20 mA signal from analyzer (if signal switching)

Number of Points: 8

Relays: DPDT sealed relays, contacts rated for 250 VAC, 220VDC maximum operating voltage. Maximum switching capacity 30W, 62.5 VA for inductive loads. The alarm contacts are normally-open dry contacts which may be powered by field voltage (less than 30 VDC and 0.5 A) from annunciator. In lieu of this standard alarm set-up, the board can be reconfigured to supply 6 VDC to remote devices, i.e., relay coils, to accommodate required high voltage alarm requirements. (See Appendix A.)

Specification for 0-1 Volt DC Output Board

Purpose: The 0-1 VDC output board is used to provide 0-1 VDC sample point number indication. The board includes alarm contacts for normally-open commutated alarm indication.

Inputs: None

Outputs: One 0-1 Volt DC signal to indicate respective sample point number currently in "dwell" time.

Number of Points: 8

Relays: DPDT sealed relays, contacts rated for 250 VAC, 220VDC maximum operating voltage. Maximum switching capacity 30W, 62.5 VA for inductive loads. The alarm contacts are normally-open dry contacts which may be powered by field voltage (less than 30 VDC and 0.5 A) from annunciator. In lieu of this standard alarm set-up, the board can be reconfigured to supply 6 VDC to remote devices, i.e., relay coils, to accommodate required high voltage alarm requirements. (See Appendix A)

Specification for Remote Electronic Track & Hold Board Assembly (7-00839A)

Purpose: The remote track & hold card has four independently isolated channels which each operate in two modes: the *track mode*, where the output follows proportionally to the input while contact terminals are closed, and the *hold mode*, where the output value is held via digital memory until the command is reset by contact closure.

This card is ideal for applications with analyzers being sequenced between multiple sample lines. The hold feature permits the last reading for each of four channels to be held until the next sequenced reading for the respective channel occurs. Use of the card prevents the non-active channels from dropping to zero between readings thereby avoiding potential system alarm problems.

The remote Track & Hold board is mounted in an enclosure remotely located from the Sample Sequencer enclosure. The advantage of using the remote Track & Hold instead of the plug-in type is that alarm contacts are available from the signal switching board. Another advantage of the remote track and hold is that it can be configured to provide multiple isolated outputs.

If a sample point is not activated after four contact closure indications have occurred on the board, the output of the unactivated point will become 4 mA. If no sample points on the board are activated within 80 minutes, all four outputs will become 4 mA.

The card is versatile to accommodate many applications. Several cards may be wired together to provide more than four channel outputs. The card is also useful for applications where multiple outputs from one analog input signal are required. For instance, the card may be used if separate analog signals for plant DCS and recorders are required.

Performance:

Accuracy ± .01% of span at 25°C
Response Time: One-second time constant
Temperature coefficient: ± 0.012% reading per 1°C

Input Analog Signal: 0-20 mA or 4-20 mA or any voltage input between 0-10 V with proper scaling resistor (plug-in socket scaling resistor - See Appendix H).
Output Analog Signals: Four 0-20 mA or 4-20 mA independently isolated at minimum 500 V per channel
Maximum Load Resistance: 600 Ohms

Enclosure: NEMA 4X, IEC529, IP67 with knockouts.

General: Power: 108-132/216-264 Vac, 47-63 Hz (jumpers for 220 Vac applications - See Appendix F)
Wiring: Screw Terminals
Enclosure: ABS watertight NEMA 1,2,3,3R,4,4X, 5,12 & 13. Europe: IP 65 to DIN 40050
Enclosure Dimensions/Mounting: 9.44" x 6.29" x 3.54" / Wall or surface mounting
Adjustments: Offset and Gain potentiometers for each output channel
Hold Control: Holds when opening the input control terminals; tracks when closing the control terminals (tracks one channel at a time)
Operating Temperature: -5 to +70°C
Operating Humidity: 90% RH max., non-condensing
Weight: 2.3 lbs.

Specification for Plug-In Electronic Track & Hold Board (6-02499E)

Purpose: The plug-in track & hold card has four independently isolated channels which each operate in two modes: the *track mode*, where the output follows proportionally to the input during the respective dwell time, and the *hold mode*, where the output value is held via digital memory until the next dwell time.

This card is ideal for applications with analyzers being sequenced between multiple sample lines. The hold feature permits the last reading for each of four channels to be held until the next sequenced reading for the respective channel occurs. Use of the card prevents the non-active channels from dropping to zero between readings thereby avoiding potential system alarm problems.

The card is versatile to accommodate many applications. One or two circuit cards may be plugged inside the Sample Sequencer to provide up to eight sample outputs.

The card can be used for applications where dual outputs from one analog input signal are required. Dual outputs are obtained by field configuration. For instance, the card may be used if dual analog signals for plant DCS and recorders are required. A maximum of four outputs or two pairs, may be obtained from each card.

The plug-in track and hold board will output 0 mA on points which are turned off.

Input Analog Signal: 0-20 mA or 4-20 mA
Output Analog Signals: Four 0-20 mA or 4-20 mA independently isolated at minimum 500 V per channel per circuit board.
Maximum Load Resistance: 525 Ohms

General: Wiring: Screw Terminals
Circuit Board Dimensions: 5.165" x 5.6"
Adjustments: Offset and Gain potentiometers for each output channel.
Operating Temperature: -5 to +70°C
Operating Humidity: 90% RH max., non-condensing
Weight: 5 oz.

SAFETY PRECAUTIONS

Before attempting to unpack, set up or operate this product, read the entire manual. Pay careful attention to all warnings, cautions and notes. Failure to do so could result in serious personal injury or equipment damage. Product warranty may be affected.

Use of Hazard Information
If multiple hazards exist, the signal word corresponding to the greatest hazard shall be used.

DANGER
Indicates an imminently hazardous situation which, if not avoided will result in death or serious injury

WARNING
Indicates a potentially hazardous situation that could result in death or serious injury

CAUTION
Indicates a potentially hazardous situation that may result in minor or moderate injury

NOTE
Information that requires special emphasis.

SHALL
This word understood to be mandatory

SHOULD
This word understood to be advisory

General Description

The *SENTRY* Sample Sequencer is a microprocessor-based instrument capable of electronically switching up to eight sample streams or sensors one at a time to one analyzer and of providing signals to recorders, alarms and computers. A manifolded Sentry sampling valve specially designed to obtain optimum representative samples is available for sample stream switching with the Sample Sequencer. The Sample Sequencer reduces the number of required analyzers while maintaining equivalent data accuracy. Reliable sample analysis comparison is obtained by using a Sample Sequencer with one dedicated analyzer. In addition, significant operation cost savings are obtained by not having to install, maintain and service multiple analyzers.

The Sample Sequencer is capable of operating in the cycle mode for continuous-type analyzers or in the batch mode for batch-type analyzers. In addition, the Sequencer is capable of measuring the analyzer analog output signal and converting the analog signal to digital data to be sent out via the Sequencer's RS-485 serial data communication port. Using the RS-485 capability, one can connect a PC via twisted pair cable to one or more sequencers for remote monitoring, control and data acquisition.

Plug-in output boards are supplied to switch the analyzer analog signal to different recorder points or to provide contact closure channel number indication for recorders. The boards also provide eight independent commutated alarm contacts for low/high analog alarm and analyzer system alarm indication. Optional boards are available to provide 0-1 VDC channel number indication for recorders or to track and hold independently isolated analog signals.

Figures 1 - 3 illustrate a typical system arrangement for sample stream switching with the Sample Sequencer. Optional boards and customer-supplied equipment are shown for clarification.

Figure 4 illustrates a typical system arrangement for sensor switching with the Sample Sequencer. Optional boards and customer-supplied equipment are shown for clarification.

Modes of Operation
The Sample Sequencer has three programmable modes of operation:

BATCH - For analyzers that take a sample "bite" (or batch), produce an analytical result and then provide a contact signal output, in typically one to 20 minutes.
CYCLE - For any continuous analysis (conductivity, dissolved oxygen, pH and sodium).

Note

If using the Sample Sequencer with a Hach analyzer, See Appendix D.

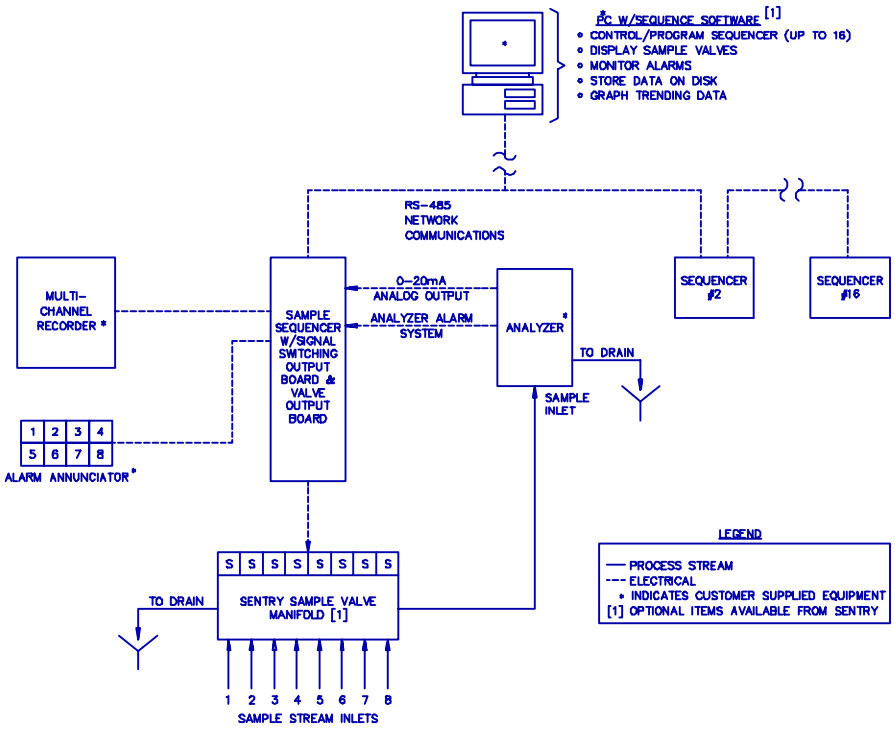


FIGURE 1 - Sample Sequencer System with Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications

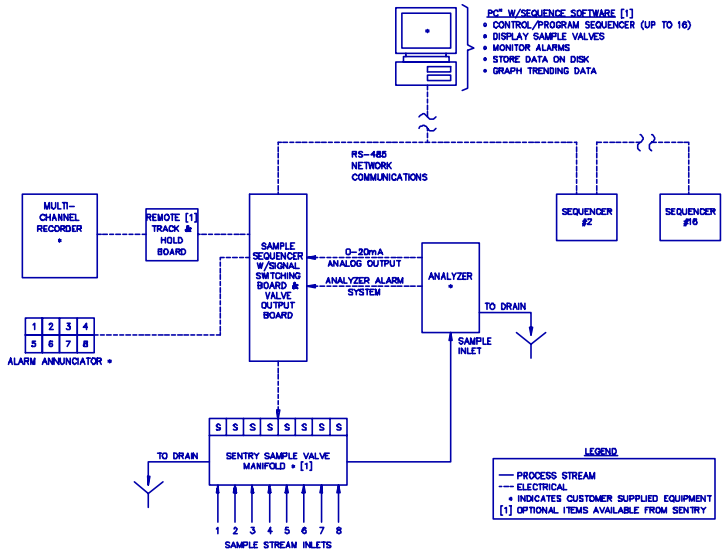


FIGURE 2 - Sample Sequencer with Remote Electronic Track & Hold Board, Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications

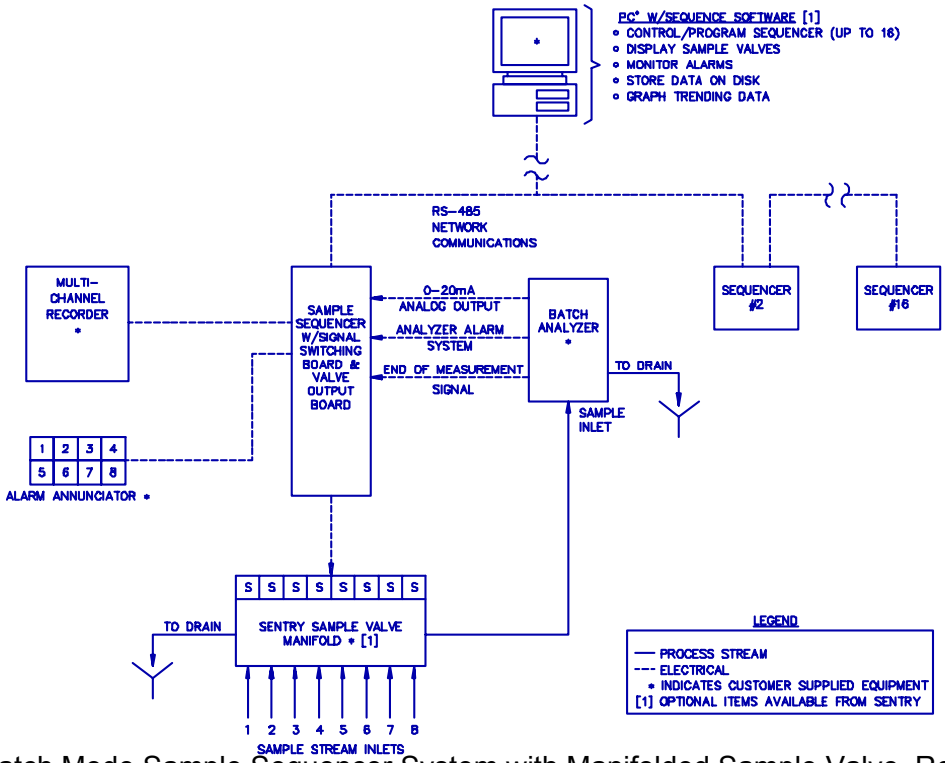


FIGURE 3 - Batch Mode Sample Sequencer System with Manifolded Sample Valve, Recorder, Alarm Annunciator and Network Computer Communications
(See Appendix D for use with Hach analyzer.)

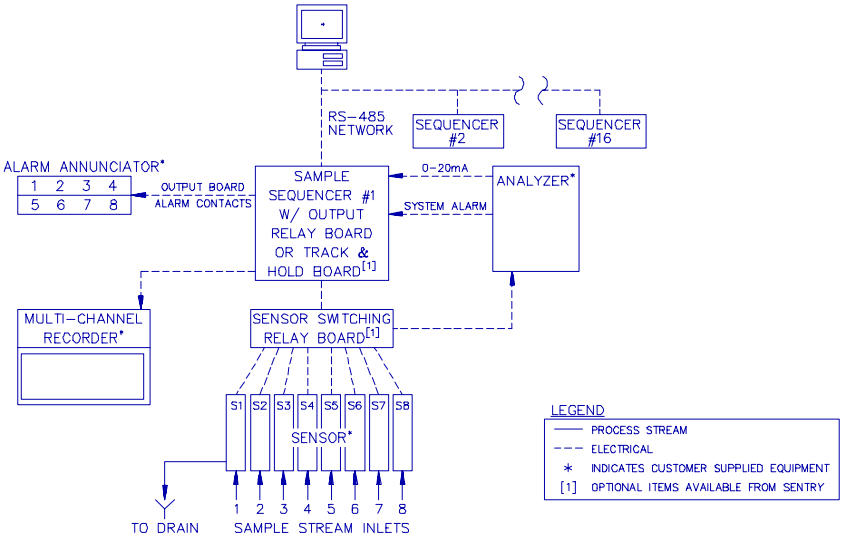


FIGURE 4 - Sample Sequencer System for Sensor Switching

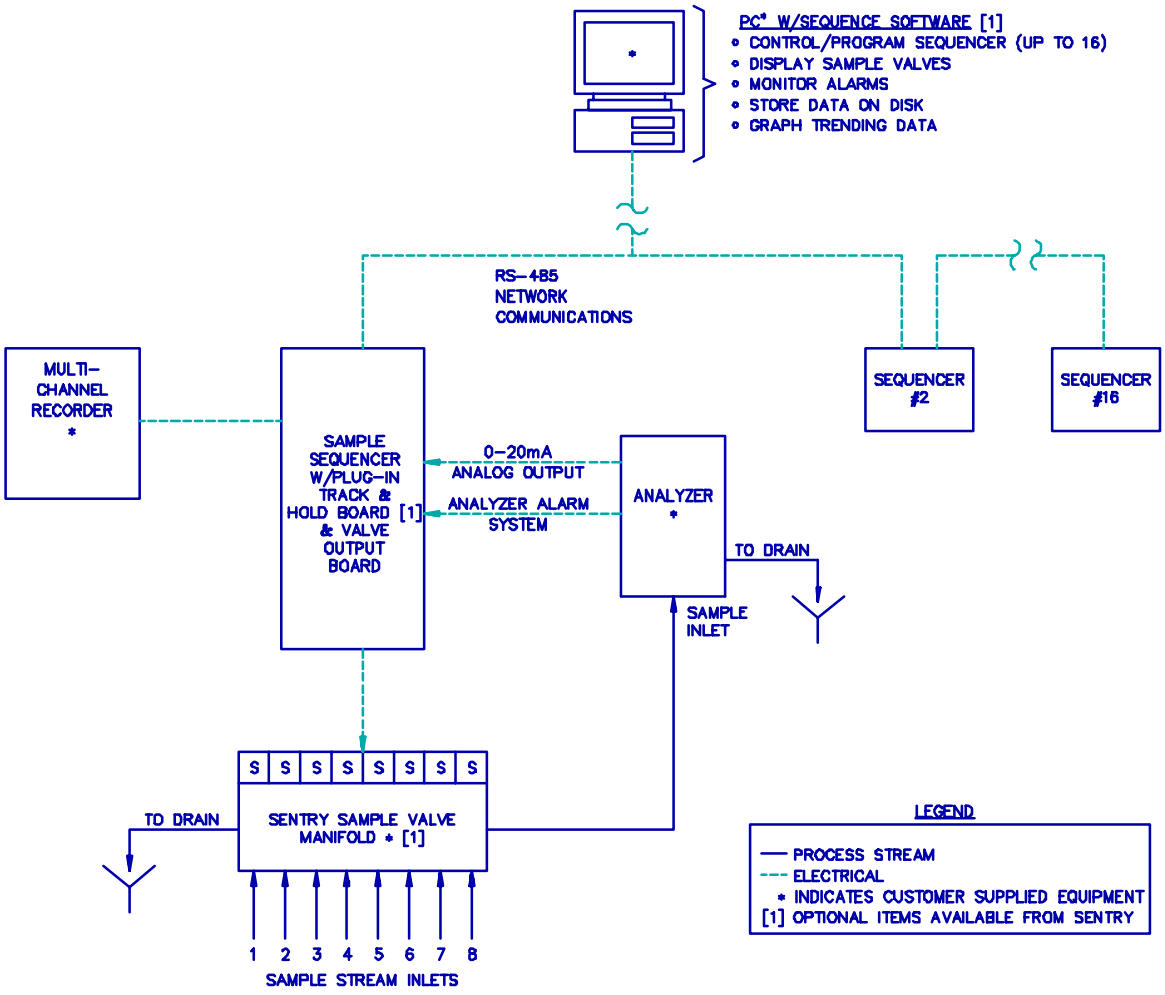


Figure 5 - Sample Sequencer with Plug-In Electronic Track & Hold Board, Manifolded Sample Valve, Recorder and Network Computer Communications

Output Boards and CRT Display

Output boards are available for the Sample Sequencer to provide a variety of outputs.

Valve Output Board: The valve output board uses relays to turn on and off maximum 250 Volts (AC or DC) electrically operated valves for switching up to eight sample streams to one analyzer. The board may be located inside the Sample Sequencer. As an option, the valve output board may be housed in a NEMA 4X enclosure for remote installations. The board includes lights to indicate current sample point number. For use with the Sample Sequencer, Sentry offers a special sampling valve for stream switching. The unique design prevents cross contamination and maintains continuously flowing samples to help provide a representative sample.

Signal Switching Output Board for Signal Switching or Contact Closure Point Indication: The signal switching output board with double pole, double throw relays is available to commutate the analyzer analog signal (signal switching) and low voltage normally-open alarm outputs to eight individual outputs. This output works well with a multipoint recorder with print holdout option. The signal switching output board may also be used with a recorder which requires a contact closure to indicate the current sample point number.

0-1 VDC Signal Output Board (optional): The 0 - 1 Volt DC signal output board is available to provide an analog signal of 0 - 1 Volt DC indicating the current sample point number. For example, sample point number one is indicated by an output of 0.1 Volt, point two by 0.2 Volt, ..., and point eight by 0.8 Volt. This option works well when there are insufficient channels on the recorder for all of the analog signals. For example, it can be used when a two channel recorder is available to sequence more than two streams. In addition, it can be used if each sample stream goes through multiple analyzers. The board also provides eight commutated low voltage normally-open alarm contacts.

Electronic Track & Hold Boards:

Plug-in Type: The plug-in electronic track & hold board installs inside the Sample Sequencer and is used to track and hold a 0 - 20 or 4 - 20 milliamp signal as output for that point in up to four separately isolated outputs. Two plug-in (6-02499E) electronic track & hold boards may be plugged into the Sample Sequencer to obtain maximum eight points of track and hold output. The electronic track & hold board has no alarms. Use the remote type electronic track & hold board (below) with a signal switching output board if alarm contacts are required.

NOTE: Only one type of signal output board, (i.e., signal switching, 0-1 VDC output, or two plug-in electronic track & hold boards), may be used in a Sample Sequencer at a time.

Remote Type: The remote electronic track & hold board (7-00839A) is similar to the plug-in type. However, it requires line power and contact closure inputs to indicate tracking sample point number. This board is used in conjunction with the signal switching output board. See specification for more information.

CRT Monitor Output: A simple computer program can be written to communicate from the controller computer to a remote computer, controller, or annunciator as all the information is available and can be transmitted using RS-485. Additional Sample Sequencers may also be connected on the RS-485 network. Sentry offers a computer program, SEQUENCE, to control, monitor, graph and record data from a Sample Sequencer.

OPTIONAL MANIFOLDED SAMPLING VALVE

Although the Sample Sequencer may be used to control most manifolded valve arrangements, the Sentry Manifolded Sample Valve offers a convenient optional accessory to obtain a representative sample. The patented design incorporates block and bleed design and provides continuously flowing samples with no areas for cross contamination to occur. The valve is available with a variety of DC and AC solenoid coils and comes in either four or eight sample line models. Contact Sentry for more information about this special sampling valve.

OPERATION

Description of Controls

Figure 6 and Table 1 describe controls on the Sample Sequencer membrane switch display.

Table 1 - Control and Display Descriptions

DESCRIPTION	FUNCTION
Sample Point switches 1-8 with light annunciators	Pushing the switches turns the sample point on and off. The adjacent light turns on when the point is on. The light blinks on and off when the point is in alarm. When the point is on, the respective sample (when sample switching) or cell signal (when sensor switching) will be analyzed in sequence.
Sample names	The removable name tag allows the sample name to be typed and displayed through the clear pocket on the membrane switch. The nametag is accessed by removing the front display plate.
Sample point display	Indicates the sample point number corresponding to the value in the display function window.
Display function display window	Indicates the value of the current function (indicated by the display function light which is on).
Display function lights	Indicates which function (CYCLE TIME, DELAY TIME, DWELL TIME, ANALOG mA, LOW ALARM, HIGH ALARM or STATION NUMBER) is currently being displayed.
Control switches	These tactile feedback switches control the displays, reset alarms and start or restart the Sample Sequencer. The DISPLAY, NEXT and ALARM RESET keys serve a different purpose when programming (see below).
Programming switch & arrows	Activates the programming mode to program new values for all display functions except ANALOG mA. For example, new values for CYCLE TIME or LOW ALARMS can be programmed. The arrows light up when the programming mode is activated. The control switches immediately above the arrows control the digit position and value when programming. For example, the DISPLAY switch becomes the "up arrow" function to increase the function display digit value when programming.
Analyzer system alarm light	When lit, indicates an analyzer system alarm.

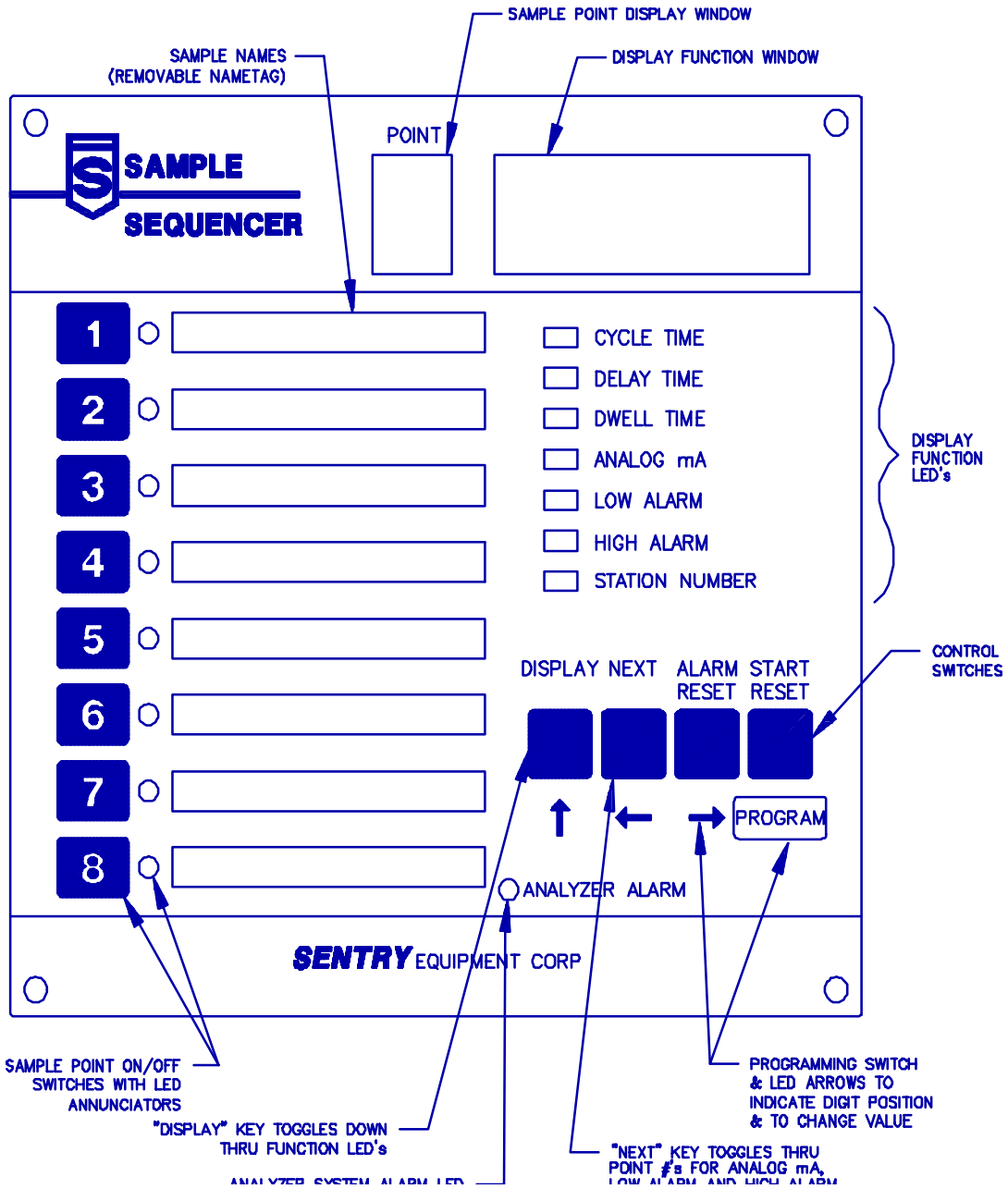


FIGURE 6 - Sample Sequencer Membrane Switch

I/O Board DIP Switches

Figure 7 shows the location of the four DIP switches at SW1 on the I/O board. The I/O board is normally supplied in the Sample Sequencer and plugs into the display board with the long dual-row 42 pin connector. The SW1 DIP switch functions are described in Table 2 below.

Table 2 I/O Board DIP Switch (SW1) Functions

SW1 No.	Description	Function	
		OFF	ON
1	Programming	Lock-out	Enable
2	Type of plug-in output board	Plug-in electronic track & hold board	Signal switching output, 0-1 volt or Remote track & hold boards
3	Calibration	Normal Operation	Calibrate Mode
4	Operation Mode	Cycle Mode	Batch Mode

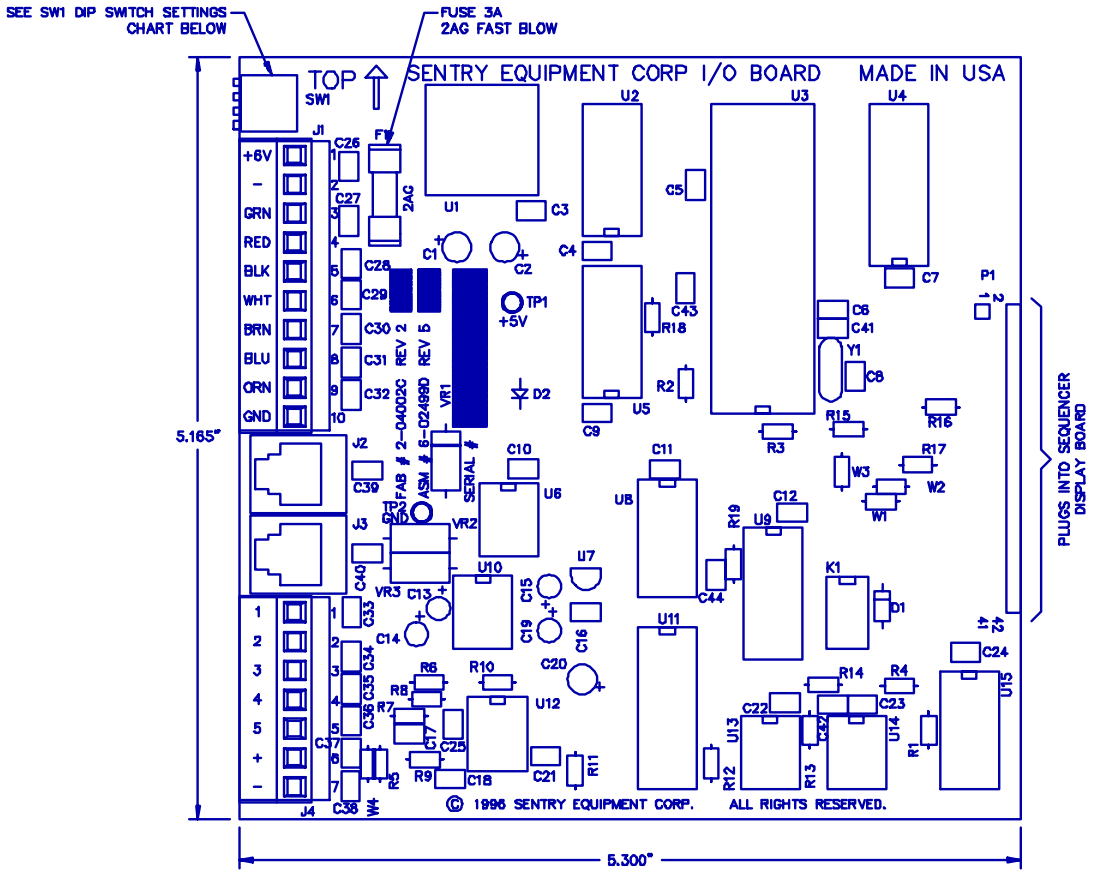
SW1-1 allows one to lock-out front panel programming by putting this switch in the lock-out (OFF) position. The ON position enables programming form the front panel.

SW1-2 configures the Sample Sequencer for the type of plug-in output board which has been installed. The switch should be in the off position if the Plug-in electronic track & hold board(s) is used. Select the ON position if either the Signal switching, 0-1 Volt DC output or remote track & hold board are used.

SW1-3 enables the calibration mode. Turn the switch On when the ANALOG mA signal display must be calibrated. This forces the Sequencer into a fixed state to conveniently calibrate the Sample Sequencer via the gain and offset potentiometers on the display board. (See the Calibration section in this manual for more information.) Turning the switch OFF turns off the calibration mode and permits normal operation. The START/RESET control switch on the front display must be pushed to start sequencing after completing calibration and turning SW1-3 OFF. Note: The Sample Sequencer is shipped factory-calibrated.

SW1-4 configures the Sample Sequencer for the desired mode of operation. The OFF position enables the cycle mode for continuous type analyzers. The ON position enables the batch mode for batch type analyzers, such as Hach Series 5000.

See Appendix D if using the Sample Sequencer with Hach Series 5000 analyzers.



DIP SWITCH SW1 SETTINGS

SW1-#	DESCRIPTION	OFF	ON
1	PROGRAMMING	LOCK-OUT	ENABLE
2	OUTPUT BOARD TYPE	PLUG-IN TRACK & HOLD	SIGNAL SWITCHING/REMOTE TRACK & HOLD
3	CALIBRATE	OFF	ON
4	MODE OF OPERATION	CYCLE	BATCH

FIGURE 7 - I/O Board Arrangement

Membrane Switch Keys

Sample Point Numbers (1-8): The eight sample point number switches turn a sample point on or off. When the point is on, the adjacent LED will light and the sample point will be analyzed sequentially.

DISPLAY: Pressing this key causes the function as indicated by the function lights to advance to the next one down and back to the top. Normally the CYCLE TIME function is selected to keep track of the analyzer cycling, or ANALOG mA output is selected to keep track of the analyzer output value. The remaining functions are used predominantly for set up, troubleshooting or programming.

NEXT: With functions: ANALOG mA output, LOW ALARMS, and HIGH ALARMS, there are eight selections, one for each point. Pressing the NEXT key displays the next higher POINT value and then back to one again.

ALARM RESET: Resets all current alarms. Points will realarm if the current value is still in alarm. Alarms can be from a low or high analog mA output value or from the analyzer system alarm. Eight successive analyzer system alarms will force the Sample Sequencer to an "OFF" mode.

START/RESET: If the key is pressed or the power is turned on, the Sample Sequencer resets, reinitializes and restarts with the first on point. The previous programmed values are read in from non-volatile memory.

PROGRAM: Pressing this key starts and stops programming as described below. An internal lock-out DIP switch on the I/O board (SW1-1 in Off position) can defeat this external key and lock-out programming from the membrane switches.

Programming
In order to operate, the Sample Sequencer must be initially programmed. Programming is accomplished either with the front display membrane switch keys or from computer signals via the built-in RS-485 serial communications.

The following items are programmed to meet analyzer and operational requirements:

- Cycle time (or batch time-out when in the batch mode)
- Delay time
- Dwell time
- Low alarm levels for each point
- High alarm levels for each point
- Station number for communications

Except for station number, the above items can also be remotely programmed using the communications software from a connected computer.

To Program:

- Press the DISPLAY key to select desired function. To select desired POINT number for the low and high alarms press the NEXT key.
- Press PROGRAM. The programming arrows light up and the current programmed value is displayed.
- Starting at the right digit, pressing the key immediately above the up arrow (DISPLAY) causes the digit to increment. Press repeatedly until the desired digit is displayed.
- Each pressing of the key above the left arrow (NEXT) shifts the active digit one to the left. The active digit may be incremented using the aforementioned up arrow key.
- Each pressing of the key above the right arrow key (ALARM RESET) shifts the active digit one to the right.
- Pressing the PROGRAM key again:
  - Turns the arrow lights off.
  - Saves the value in permanent memory.
  - Returns the Sample Sequencer to its normal display.
  - The newly programmed values are active on the next cycle. Press START/RESET to restart the sequencer using the new values.

Display Functions:

Functions shown in Figure 6 may be displayed on the Sample Sequencer. Pressing the DISPLAY key toggles through the below functions. The light adjacent to the display function lights to indicate the function is displayed. The NEXT key toggles through successive function point numbers (1-8) for ANALOG mA, LOW ALARM and HIGH ALARM.

- CYCLE TIME (or time-out count-down for batch mode) - time duration to sample a point
- DELAY TIME - time to delay the analysis signal upon starting the cycle
- DWELL TIME - time period that analysis signal is read and switched after delay
- The following three items display milliamp values of 0 to 20 mA . Values for each of the eight points are displayed by pressing the NEXT key.
  - ANALOG mA - the input analysis signal value
  - LOW ALARM values
  - HIGH ALARM values
- STATION NUMBER used in communications (1-16).

CYCLE TIME, DELAY TIME and DWELL TIME are discussed in the operating mode section below.

ANALOG mA Input Analysis Value: All analog values are in milliampere form for either 0 to 20 or 4 to 20 milliampere range. On selection, the value for sample point number one is displayed. Pressing the NEXT key will display the next higher point up to eight, and then from eight back to one. As the unit processes the active sample points, any points not on will be skipped and the value zeroed. In cycle or batch mode (described below) the values are retained only for the time required to complete an analysis circuit of the on points. In manual mode only the active point is on. If the unit is in the OFF mode, all values are zeroed.

If an optional electronic track & hold board is used to provide individual milliampere outputs, all eight values are refreshed each second. If a signal switching output board is used, the active value is output during the dwell time only. All values are immediately available to a computer connected to the communication port.

LOW ALARM LEVEL: The programmable low alarm level in milliamps is displayed for each sample point. Pressing the NEXT key displays successive values. To reprogram a low alarm value, press the PROGRAM key and follow the directions in the section on programming. Pressing the PROGRAM key again terminates programming and saves the value in non-volatile memory. These values are also programmed by communicating the required protocol from a connected computer and current values can be sent, on request, from the Sample Sequencer to a computer. Note: The low and high alarm values are programmed in milliamp values. Selection of the appropriate value should take the analyzer's measurement range and span into consideration.

During the valid dwell output time, depending on the mode, the input signal is compared to the low alarm level and if the signal is less, an alarm state is initiated for that point. The respective sample point light on the Sample Sequencer display at that point selection switch will blink each second. Pressing the alarm reset key stops the blinking, but the alarm can reinitiate if the condition still exists and is dwelling on the point number. If an optional signal switching output board is used, a low voltage (<30 VDC) dry contact closure alarm signal or 6 VDC output signal is commutated, depending on board configuration.

HIGH ALARM LEVEL: Functions the same as for low alarms, but will go into alarm if the input signal is equal to the programmed high alarm value.

STATION NUMBER: The station number function assigns a station number of 1 to 16 to the Sample Sequencer unit. The station number identifies the unit when operated with the built-in RS-485 serial communication network. This station number should be different from other Sample Sequencers on the computer network. The station number assignment can only be performed with the front panel display

PROGRAM key on the Sample Sequencer. The programming procedure is similar to that described for programming the alarms. See the manual section on communications for more information about the network communications.

OPERATING MODES:

OFF, CYCLE, BATCH

OFF If there are no sample points on, or if a BATCH time out has occurred, or calibration has been used, or after eight successive analyzer alarms, the Sample Sequencer goes into the OFF mode. This is the normal preferred standby mode.

Even when the unit is "OFF", it is still able to:

Program
Calibrate
Communicate

A local or remote START/RESET starts the Sequencer again.

CYCLE This mode is for continuous output analyzers such as sodium, conductivity, pH, O_2, some colorimetric, and many others. Two system methods are used: sample stream switching and sensor switching.

Sample Stream Switching where successive sample streams are switched through the same analyzer apparatus. An electrically actuated manifolded valve arrangement is typically used to accomplish the stream switching. Sentry offers a technology-leading sampling valve for stream switching.

Sensor Switching where relatively simple sensors can be placed in each sample line and the electrical leads to the analyzer can be successively switched to the analyzer.

Timing Considerations for the Cycle Mode:

Figure 8 illustrates the concept of cycle, delay and dwell times for the cycle mode of operation. Figure 8 demonstrates how each sample stream is switched for the duration called cycle time. The analyzer output signal is switched through the Sample Sequencer after the delay time period for the dwell time duration. When using the Sample Sequencer for sensor switching, the only difference from stream switching is that the sensor signal is switched instead of a valve during the cycle time. The following considerations should be made when determining the timing for your system.

CYCLE Time is the time period of each sample point during which stream or sensor signal switching occurs. Shorter cycle times yield faster analytical updates among the points while longer cycle times provide sufficient time to recognize stable readings. Short cycle times are achievable by minimizing sample line length from the manifolded valve to the analyzer, eliminating dead legs and by short analyzer response time. The cycle time may be optimized by determining the maximum time period required for each sample point to stabilize and using this as the cycle time. Note, the cycle time value must provide enough time to fulfill the requirements for delay and dwell. For example, the cycle time must be long enough for delay and dwell to count down before the next dwell time period initiates. *(In other words, the dwell time must be set less than or equal to the cycle time.)*

DELAY Time. After switching to a successive stream or sensor, there will be a settling time for the analyzer to stabilize to the new sample: This DELAY time could be seconds to a

minute or more for stream switching. The analyzer analog output signal is ignored during the delay time. The necessary delay depends on the valve manifold design, sample line length from the manifold arrangement, sample velocity, analyzer response time, sample constituents and differences between the amount of constituents for each sample point. When switching sensors, the sensor signals are usually recognized quickly by an analyzer and the delay time should be set accordingly, i.e., approximately 1-2 seconds.

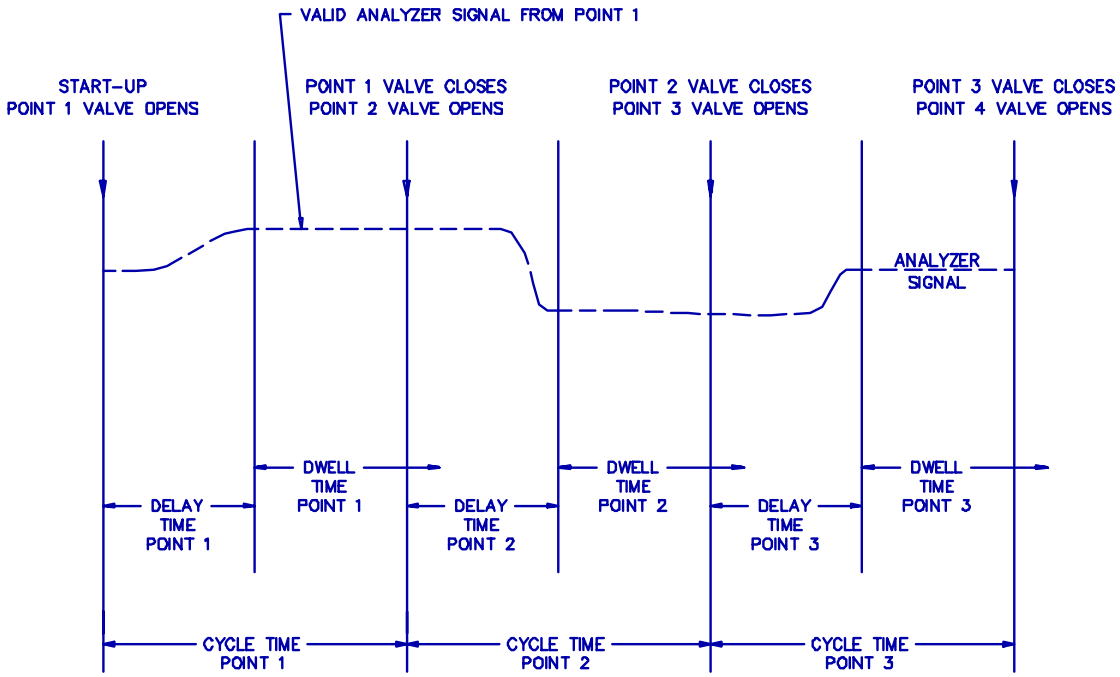
DWELL Time is the time period during which a valid analyzer signal is switched through the Sample Sequencer during which time Sequencer alarms are commutated. The dwell time required will depend on the destination device such as a data logger, computer, recorder, etc., for both the analog data and the alarm output. The output signal must be valid for this whole DWELL time.

For instance, if output is to an eight point recorder with a print-out cycle time of 3 seconds per point, a minimum of 24 seconds plus would be the minimum DWELL time. Connecting to a computer system could have a minimum DWELL time requirement of 3 to 5 seconds or more. The only penalty for long dwell time is it may increase the cycle time and decrease responsiveness.

The DWELL time can be left on until the next on sample begins to modify the result as shown in Figure 8.

Alarms are evaluated only during the DWELL time.

The DELAY time and DWELL time must be at least one second less than the CYCLE time.



NOTES:

1.) THE DELAY AND DWELL TIMES SHOULD BE SET IN ORDER TO ACHIEVE A VALID, (i.e., STABLE), READING DURING THE DWELL TIME.

2.) NOTE HOW DWELL TIME MAY EXTEND INTO THE NEXT POINT'S CYCLE TIME. HOWEVER, THE DWELL TIME SHOULD NOT EXTEND PAST THE START OF THE NEXT POINT'S DWELL TIME.

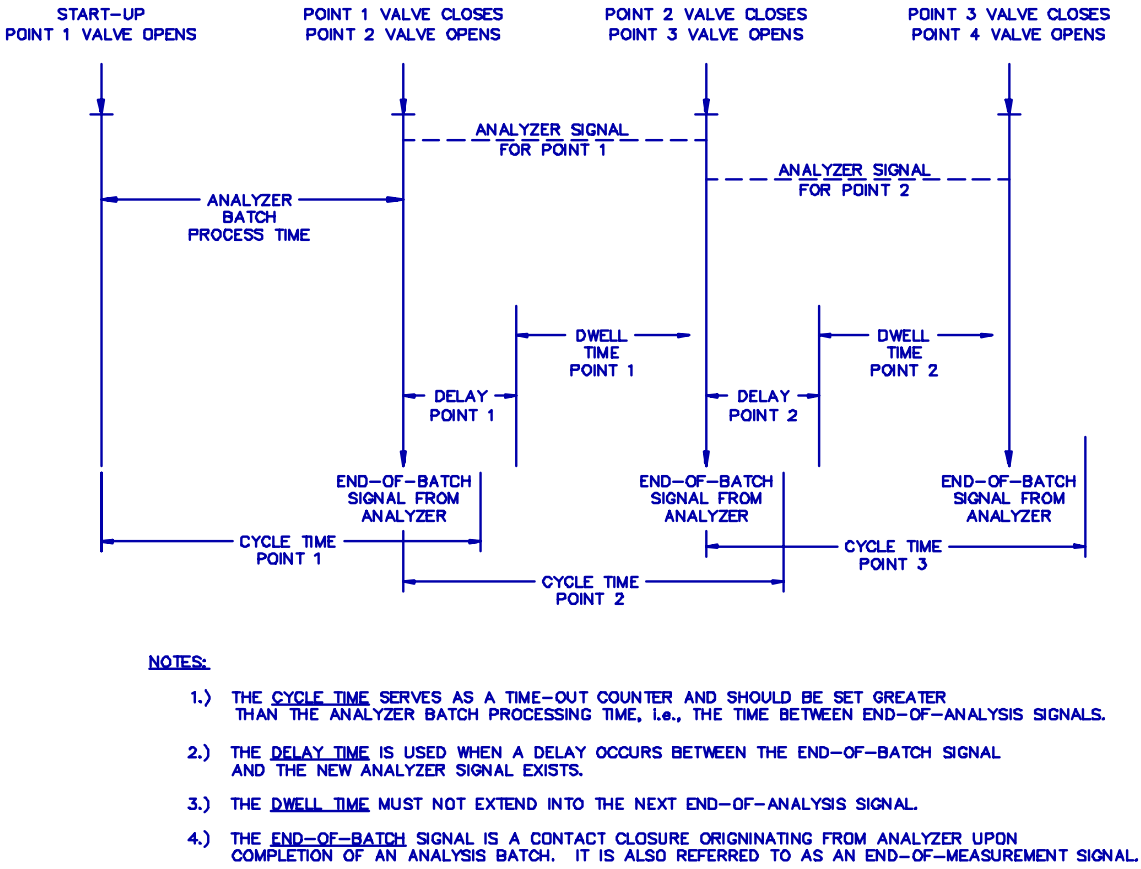
FIGURE 8 - Cycle Mode Timing Diagram

BATCH

The batch mode is for analyzers that take a "bite" or batch of sample and then spend some time analyzing it before outputting a new fixed analog signal. Typical types are reagent additive, chromatographs, etc. When these analyzers have completed an analysis there is just one output value until the analyzer's next cycle is completed, (as opposed to a continuous analyzer that shows the contemporary trend.) The Hach Series 5000 analyzer operates in this manner.

See Appendix D for instructions about connecting a Hach 5000 analyzer to the Sample Sequencer.

An "End-of-Analysis" contact closure signal is often provided at the conclusion of a batch by the batch type analyzers. Note: The term, End of Measurement, is often used in place of "End of Analysis". Following the end-of-analysis, the analyzer provides a specific protocol of the analog output values to the Sequencer.



NOTES:

1.) THE CYCLE TIME SERVES AS A TIME–OUT COUNTER AND SHOULD BE SET GREATER THAN THE ANALYZER BATCH PROCESSING TIME, i.e., THE TIME BETWEEN END–OF–ANALYSIS SIGNALS.

2.) THE DELAY TIME IS USED WHEN A DELAY OCCURS BETWEEN THE END–OF–BATCH SIGNAL AND THE NEW ANALYZER SIGNAL EXISTS.

3.) THE DWELL TIME MUST NOT EXTEND INTO THE NEXT END–OF–ANALYSIS SIGNAL.

4.) THE END–OF–BATCH SIGNAL IS A CONTACT CLOSURE ORIGNINATING FROM ANALYZER UPON COMPLETION OF AN ANALYSIS BATCH. IT IS ALSO REFERRED TO AS AN END–OF–MEASUREMENT SIGNAL.

FIGURE 9 - Batch Mode Timing Diagram (For Batch-Type Analyzers)

Timing Considerations for the Batch Mode:

Figure 9 illustrates the concept of cycle, delay and dwell times for the batch mode of operation. Figure 9 demonstrates how each sample stream is switched when the analyzer outputs an "end-of-analysis" signal to the Sample Sequencer. If the Sample Sequencer doesn't receive an end-of-analysis before the cycle time expires, the Sequencer goes into the off mode and the analyzer alarm light on the front display goes on. Upon receiving an end-of-analysis signal from the analyzer, the Sample Sequencer switches the analyzer output signal for the previous sample point after the delay time period for a period of time equal to the dwell time. Note: The delay and dwell time point numbers always lag the cycle time point number by one because it is a batch process.

Note: If using a Hach analyzer, see Appendix D.

The following considerations should be made when determining the timing for your batch mode system:

End-of-Analysis (or End-of-Measurement). This signal is received by the Sample Sequencer (at terminals J4-3 and J4-4 on the I/O board) when the analysis is completed and the analyzer is ready to output the results and is available to begin a new analysis.

CYCLE TIME. The cycle time period in batch mode is an alarm condition such that if an end-of-analysis signal has not been received before cycle time counts down to zero, something is wrong with the analyzer and any further processing is impossible. Upon cycle time expiring, the ANALYZER ALARM light on the Sample Sequencer display is initiated and the unit goes into the "OFF" mode. The cycle time should be set at a value greater than the analyzer batch process time.

DELAY TIME begins when the end-of-analysis signal is received and until valid outputs from the analyzer are available. One second plus any programmed delay time will elapse before the Sample Sequencer looks at the analyzer output signals. Set the delay time for the amount of time it takes the analyzer to output a new signal after it has issued an end-of-analysis.

DWELL TIME. During the dwell time the Sequencer reads in the analysis value, saves it and communicates as determined by output options and/or the value is communicated to a computer, recorder, data logger, etc. The DWELL time must be long enough to satisfy the output devices, (i.e., recorder computer, etc.), requirements. The sum of delay and dwell times must be less than the analyzer end-of-analysis signal time period.

Turning Sample Streams On and Off

Sample streams may be removed from switching by turning the appropriate sample point number off; streams may be turned on by turning the point number on. See the section in this manual titled Membrane Switch Keys [sample point numbers (1-8)] for information about turning streams on or off from the Sample Sequencer display. The points may also be controlled via a computer using the built-in RS-485 network communications. See Communications section for more information.

If the Sample Sequencer is currently on a sample point which you turn off, the point will complete the entire cycle (including delay and dwell) and then be skipped on the next sequence occurrence. If you wish to move on to the next point immediately, press the START/RESET switch on the front display.

Advancing Streams
Sample streams may be advanced to any desired point number. Turn on the desired sample point number by pressing the respective sample point number switch (1-8) and verifying the adjacent point light is on. Then, turn off the intermediate point numbers and press the START/RESET key. The desired sample point number will be on. Turn on previous sample points which are desirable.

Holding on One Sample Point
Occasionally, it is necessary to hold an analysis on one sample point. Simply turn off all the undesired sample points by using the respective sample point number switch (numbered 1-8 on front display). The adjacent lights should turn off. Now, the Sample Sequencer will keep sequencing on the one point. Thus, the normal cycle time, delay time and dwell times will be used. Depending upon the programmed values for these times, one may or may not receive a continuous analog signal through the Sample Sequencer.

Alarms
The Sample Sequencer has several alarm capabilities. There are analog alarms and an analyzer system alarm. These alarms may be annunciated in several ways. See Display Functions in this manual for information about setting low and high alarm levels. See Programming to learn how to program the analog alarm values from the Sequencer front display.

Analog Alarms: The Sample Sequencer has the ability to determine and initiate low and high analog alarms. The analog alarms may be annunciated in several ways, depending upon what optional output boards are installed in the Sample Sequencer.

A low or high analog alarm is annunciated on the Sample Sequencer front display by blinking the sample point number light. The blinking continues until: (1) the sample point alarm condition is corrected and then sampled again, or (2) the ALARM RESET switch is pressed while not dwelling on the alarming sample point.

The analog alarm may also be annunciated by contact closure using one of the optional signal switching output boards, i.e., the Signal switching output board for signal switching or the 0-1 VDC Signal switching output board. These boards have normally-open (N.O.) dry alarm contacts for low voltage signals (<30 VDC) which are closed upon alarm during the dwell time period for the respective point, i.e. commutated alarms. **DANGER: Do not apply high voltage to the alarm contact terminals!**

The alarms may also be annunciated by connecting the Sample Sequencer to a computer via the built-in RS-485 network communications.

In lieu of using dry alarm contacts, the Sample Sequencer may be configured to source (i.e., output), an unregulated 6 VDC 0.5 A maximum signal to indicate an analog alarm. The signal may be used to power a remote relay having contacts suitable for a high voltage application. See Appendix A for directions on the board configuration to accomplish this.

Analyzer System Alarm: The Sample Sequencer also recognizes one analyzer system alarm. The analyzer system alarm is normally initiated by the analyzer if the analyzer has this capability (e.g. Hach 5000 series analyzers) by a normally-open (N.O.) contact closure. The analyzer should initiate this system alarm when a significant problem has occurred, i.e., loss of reagents, failure of critical measurement components, loss of sample pressure, etc. The system alarm contact closure is recognized at terminals J4-2 and J4-5 on the I/O board of the Sequencer. *Note: Do not connect the analyzer analog alarms to the system alarm terminals on the Sequencer as this*

defeats the purpose of the Sequencer's analog alarms and may make the Sample Sequencer go into the Off mode erroneously.

The analyzer system alarm is annunciated by the Analyzer Alarm light on the Sequencer display (see Figure 6). The light will remain on until the analyzer system alarm stops. This alarm is also annunciated by the commutating normally-open alarm contacts on the optional Signal switching output board and 0-1 VDC Signal output boards. After two minutes, the Sequencer will switch to the next point. The dwell cycle is still active. The user should program the analyzer to go low or high, as desired, upon analyzer system alarm.

During batch mode operation, the Sample Sequencer will initiate an analyzer system alarm if an end-of-batch signal is not received before the end of the cycle time count down. The Sample Sequencer will also turn off when this condition occurs.

If at any time the analyzer outputs a system alarm to the Sample Sequencer on eight consecutive points (regardless of the number of sample points turned on), the Sample Sequencer will turn off, terminate sampling and light the analyzer system alarm LED on the front display. This condition implies a problem with the analyzer or sample streams exists and must be corrected before sample sequencing may proceed.

Sample Nametag

Figure 10 shows the sample nametag which may be removed from the rear of the display assembly by removing the front display bezel and four screws. The bezel may be snapped off by lightly prying with a flat screw driver on one of the corners. The nametag slips into the pocket on rear of the display. One may type the desired sample names slightly above the respective lines and insert the nametag back into the display. Sample number one is on the top line. Two nametags are shipped with each Sample Sequencer.

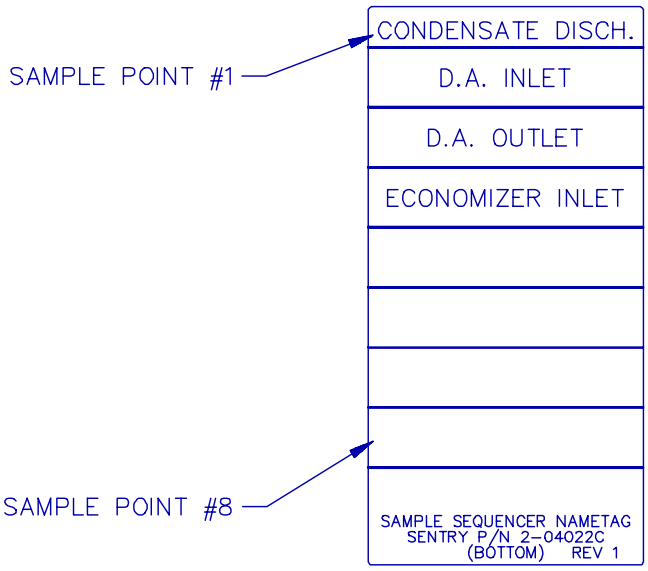


FIGURE 10 - Sample Nametag

INSTALLATION

Some of the tasks in this section of the manual have safety issues associated with them. Sentry Equipment Corp strongly recommends that qualified personnel conduct the installation, and that all installation personnel study the associated instructions carefully.

Unpacking
After carefully removing the Sample Sequencer from its shipping carton, inspect it for any damage. If damage is evident, please contact Sentry Equipment Corp immediately.

Mounting
It is recommended the Sample Sequencer be mounted close to the analyzer to permit viewing of both devices at the same time. This allows a visual check by the operator to determine which sample point is currently being sampled and relate it to the measurement being displayed on the analyzer and signals being sent to nearby recorders.

The Sample Sequencer may be panel mounted with included hardware which slides onto the enclosure mounting bosses. A panel gasket is also included and should be placed between the Sequencer and panel front. See Figure 11 for panel mounting information.

If the Sample Sequencer will not be panel mounted, the optional NEMA-4X rear cover plate may be purchased to protect the instrument from wet, dusty or corrosive ambient environments. The NEMA 4X plate permits table-top usage or surface-mount installation. See Figure 12 for mounting dimensions.

Figure 13 shows mounting dimensions for the remote Track & Hold board enclosure.

Figure 14 shows mounting dimensions for the remote valve output board enclosure. This board is mounted remote when two (2) Plug-In Track & Hold Boards are used.

Remove the rear cover plate prior to wiring the Sample Sequencer.

Conduit Connections
Knockouts for six 1/2 inch conduit connection or cord grips are provided on the bottom of enclosure. It is recommended an additional conduit nut be installed on outside of box to prevent mechanical interference between conduit connector and circuit board relays on the valve output and signal switching boards.

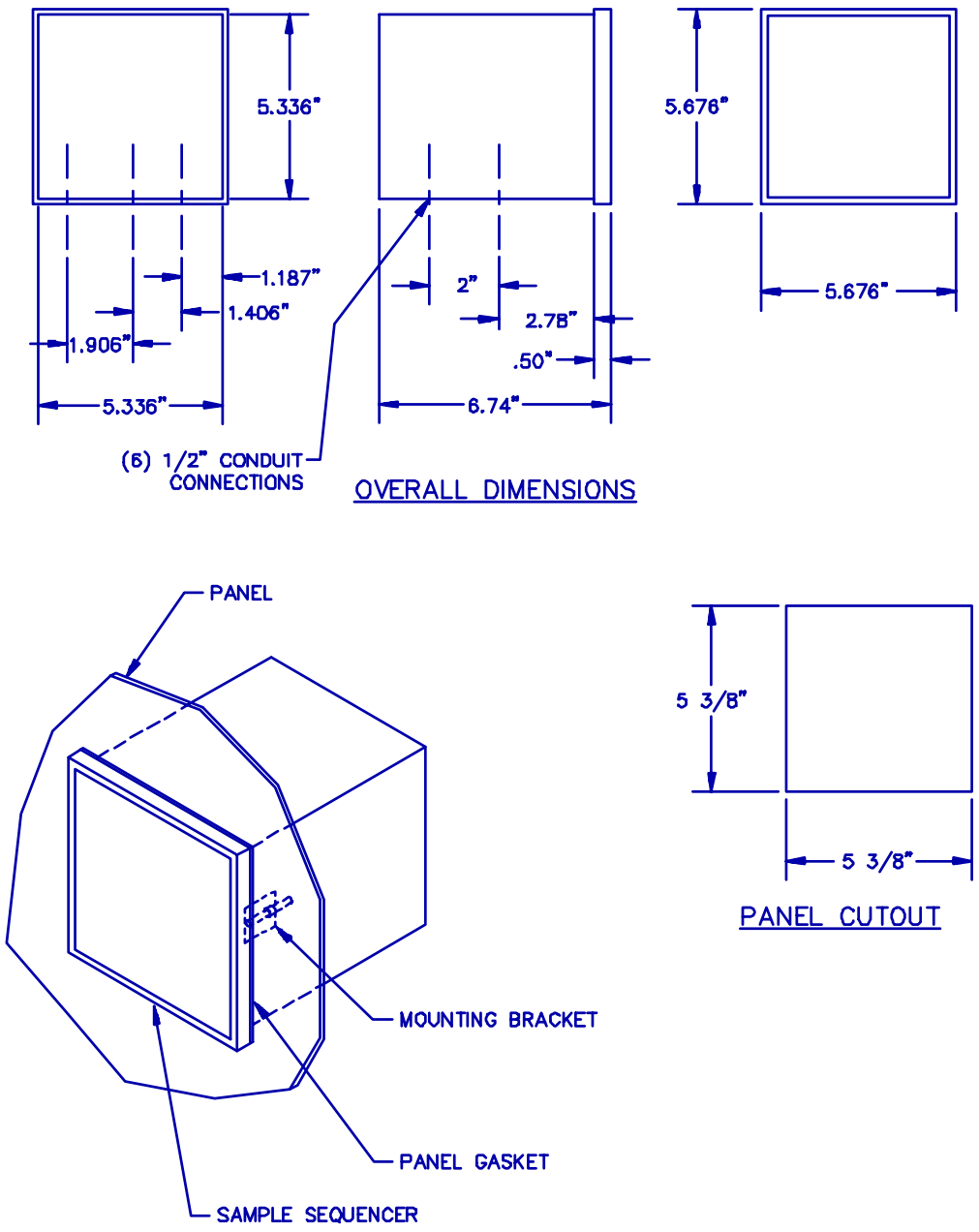


FIGURE 11 - Panel Mounting & Overall Dimensions
Sample Sequencer

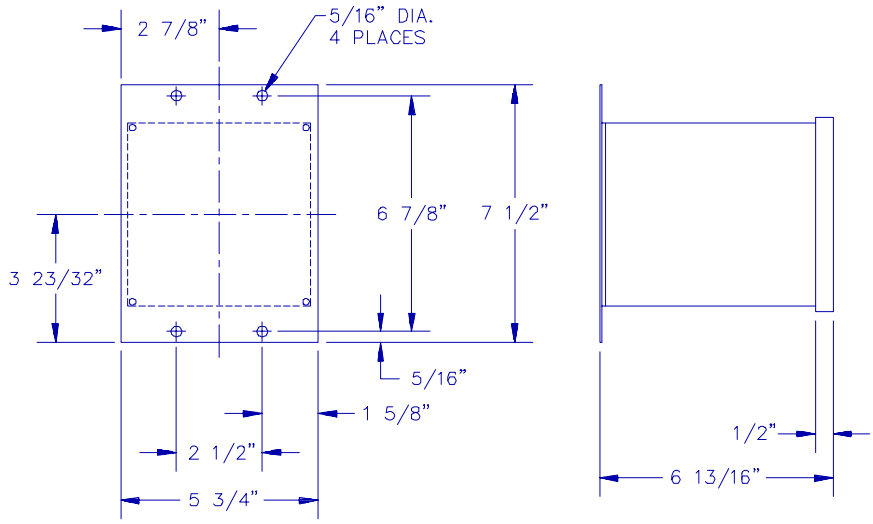


FIGURE 12 - NEMA 4X Rear Cover & Surface Mounting

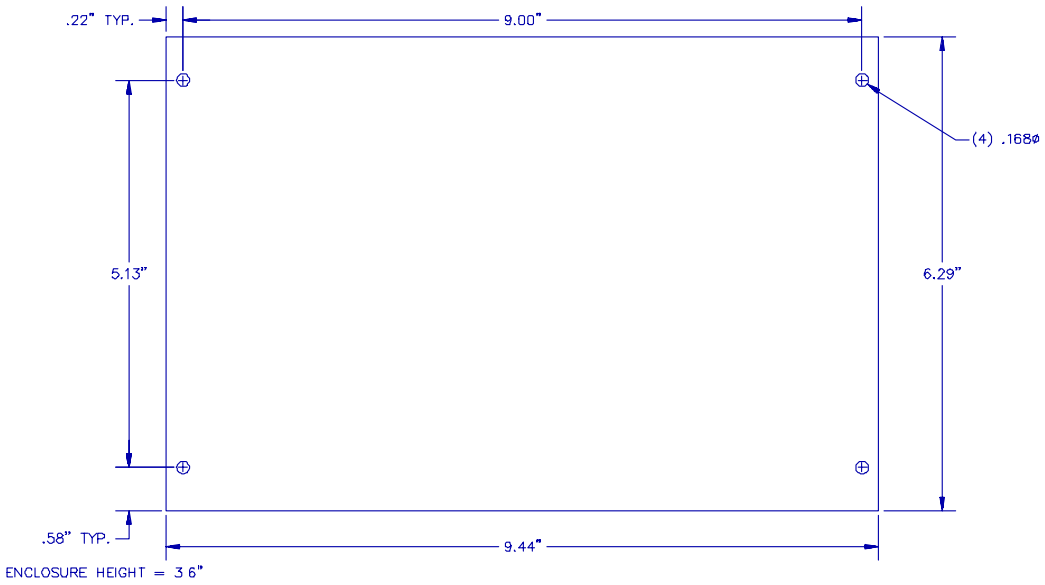


FIGURE 13 - Enclosure Overall Dimensions
Remote Track & Hold

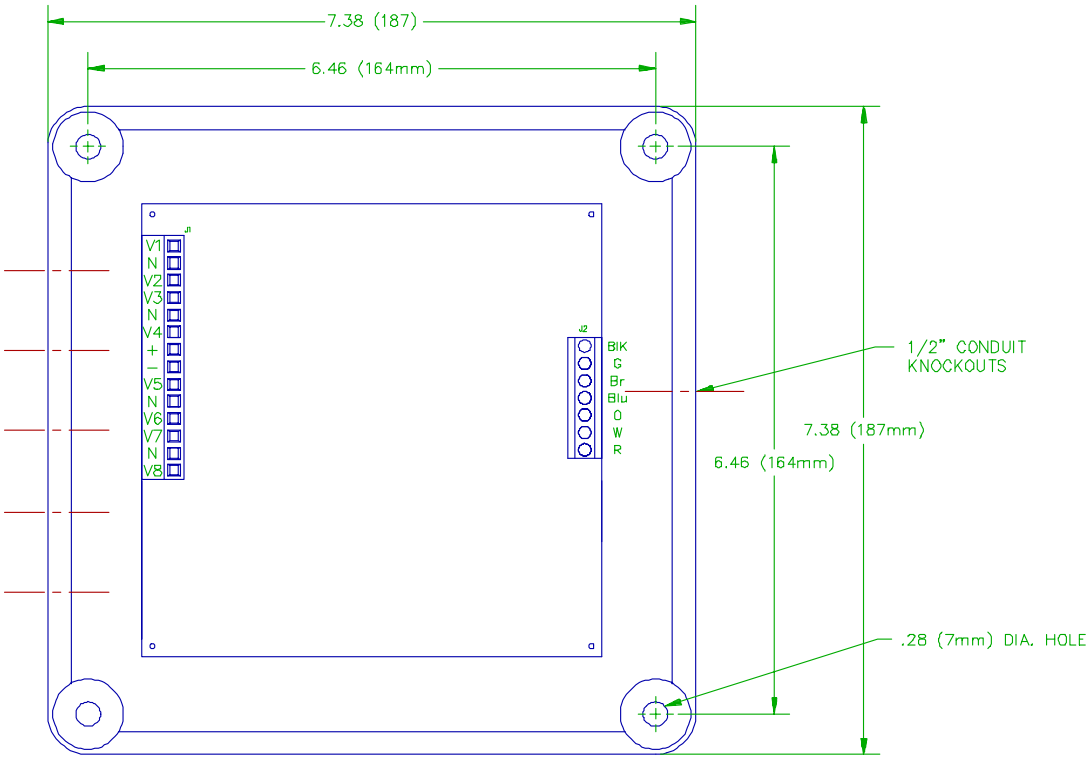


Figure 14 - Remote Valve Board Enclosure Dimensions

Power and Ground Connection

An external wall-mount type of power supply is shipped with each Sample Sequencer. The power supply provides **unregulated 6VDC power** to the instrument. The power supply comes standard as a 120 VAC device. Optional power supplies for other line voltages and outlet plug styles are available from Sentry Equipment Corp.

It is recommended the power supply be plugged into an electrical outlet or outlet strip with surge suppression and filtering such as an Isobar made by Tripp Lite. The power supply may also be installed in an electrical junction box and wired with conduit to instrument-quality power, if desired. Install according to local codes and procedures. Any cables connecting to the Sequencer which are over 32 ft. (10 m) in length should also have surge protection devices installed.

The power supply black lead is positive (+6VDC) and the white striped lead is negative (-). Connect the respective lead to the +6V and - terminals on the I/O board terminal block J1. Attach a 14 gauge conductor from an earth ground point to the braided drain wire crimp connector labeled "EARTH GND". See Figures 7 and 15. **Warning:** The drain wire from the display board mounting screw must be grounded to protect your unit from electrostatic discharge effects.

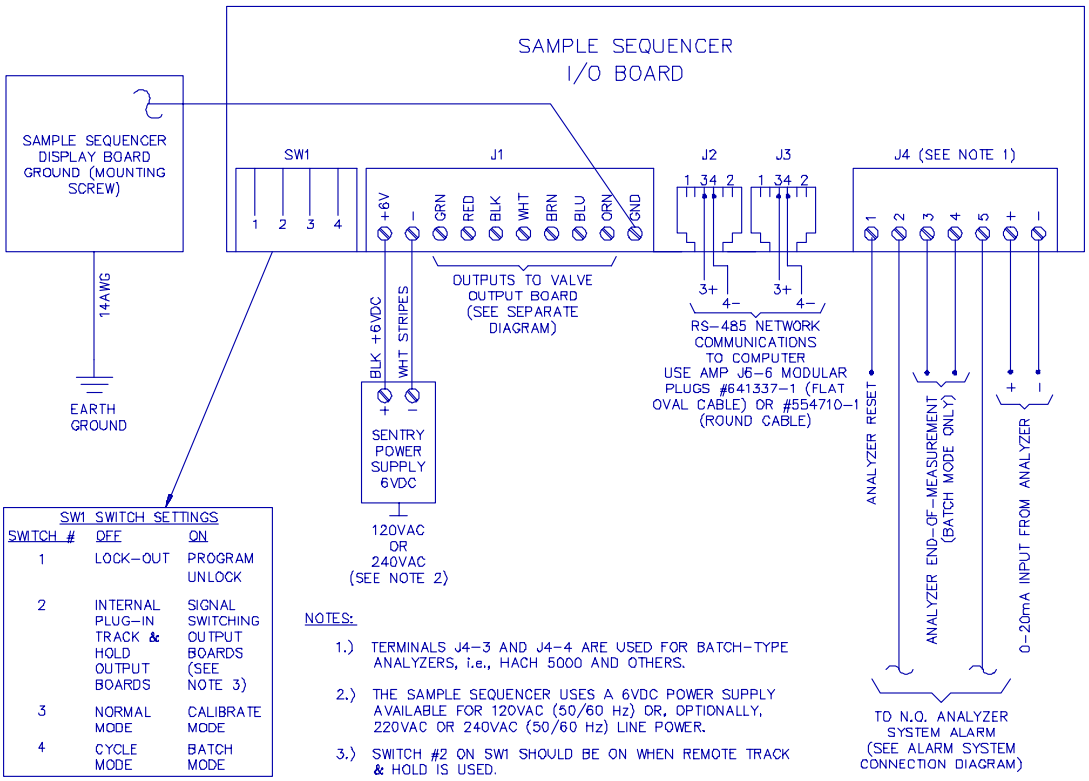


FIGURE 15 - I/O Board Connections

I/O Board Connections and Settings
CAUTION: Disconnect power to the Sample Sequencer before proceeding with installation.

Figure 13 shows connections made to the I/O board. All wiring to the I/O board should be performed with 22 gauge conductor. However, the ground should be 14 gauge minimum.

Analog Input: Connect the analog signal from the analyzer to the + and - terminals on J4 using 22 gauge conductor. Maximum recommended length is 32 ft (10m).

RS-485: Connect J6-6 modular plug with flat or round cable into terminals J2 and/or J3. These terminals may be daisy-chained to other devices on the same RS-485 network. See the I/O board arrangement diagram for proper polarity of conductors. Only the two center conductors are used for RS-485 communication. Long distances, i.e., greater than 100 feet, should use twisted pair cable to eliminate RFI and EMI noise interference on the network.

Analyzer system alarm: Connect the analyzer system alarm (not analog alarm) to terminals 2 and 5 on J4. This should be a non-powered line used for dry-contact closure indication only. Use 22 gauge conductor cable up to 32 ft. (10m) length. **NOTE: Do not connect, analyzer analog alarms to these terminals!** See Alarms. ***If using a Hach 5000 analyzer, see Appendix D for wiring diagram.***

End-of-Analysis: For batch mode operation (see Operating Modes in this manual), connect the appropriate terminals from a batch type analyzer to terminals 3 and 4 on J4 using 22 gauge conductor cable up to 32 ft. (10m) length. Consult the analyzer manual to properly configure the analyzer to send an end-of-analysis signal. Note: These terminals are *not* used when operating the Sample Sequencer in the cycle mode. *If using a Hach 5000 analyzer, see Appendix D.*

Connections to Valve Output Board: Using the supplied 22 gauge eight conductor (Belden 8456) cable, connect the appropriate color lead to the labeled terminals on J1. Maximum recommended cable length is 32 ft. (10m).

DIP Switch Settings: See Table 2 and Figure 7 for proper settings of the DIP switch bank (SW1) on the I/O board. These switches must be set correctly for the Sample Sequencer to operate as required.

Power: See Power and Ground Connections

Sample Valve Electrical Connection to Valve output board

1. Determine the power source for the electrical valves. Sentry Equipment offers a special sample valve manifold with optional DC power supplies for DC solenoids if required
2. **DANGER**: To avoid danger, disconnect power before performing this step. Connect the valve power source conductors (choose the appropriate gauge size for the breaker amp service at job site) to terminals labeled + and - on J1 of the Valve output board. This board is installed inside the Sample Sequencer or, as an option, in a remote NEMA 4X enclosure. Knockouts for 1/2" conduit are provided. Seal any unused knockouts. See Figure 16 for the wiring drawing.
3. Connect one 22 gauge wire from each valve to terminals V1 through V8 on terminal block J1 of the valve output board. **WARNING: If the Sentry sample valve with integral 3/8" cable grip connector is used, the valve cable selected must fit snugly in the 3/8" connector. A larger gauge size may be necessary to achieve snug fit.**

4. Connect one 22 gauge wire from each valve to a neutral terminal labeled N on terminal block J1 of the valve relay board. See above warning about using 3/8" cable with Sentry valve.
5. The valve board in the standard Sample Sequencer comes pre-wired to the I/O Board. If using the optional remote valve output board, then connect the 22 gauge seven conductor cable (Belden 9430) from the color coded J1 terminals on the Sample Sequencer I/O board to color coded J2 terminals on the valve relay board. Knockouts for 1/2" conduits are provided in remote valve board enclosure. The maximum cable length recommended is 32 ft. (10m).

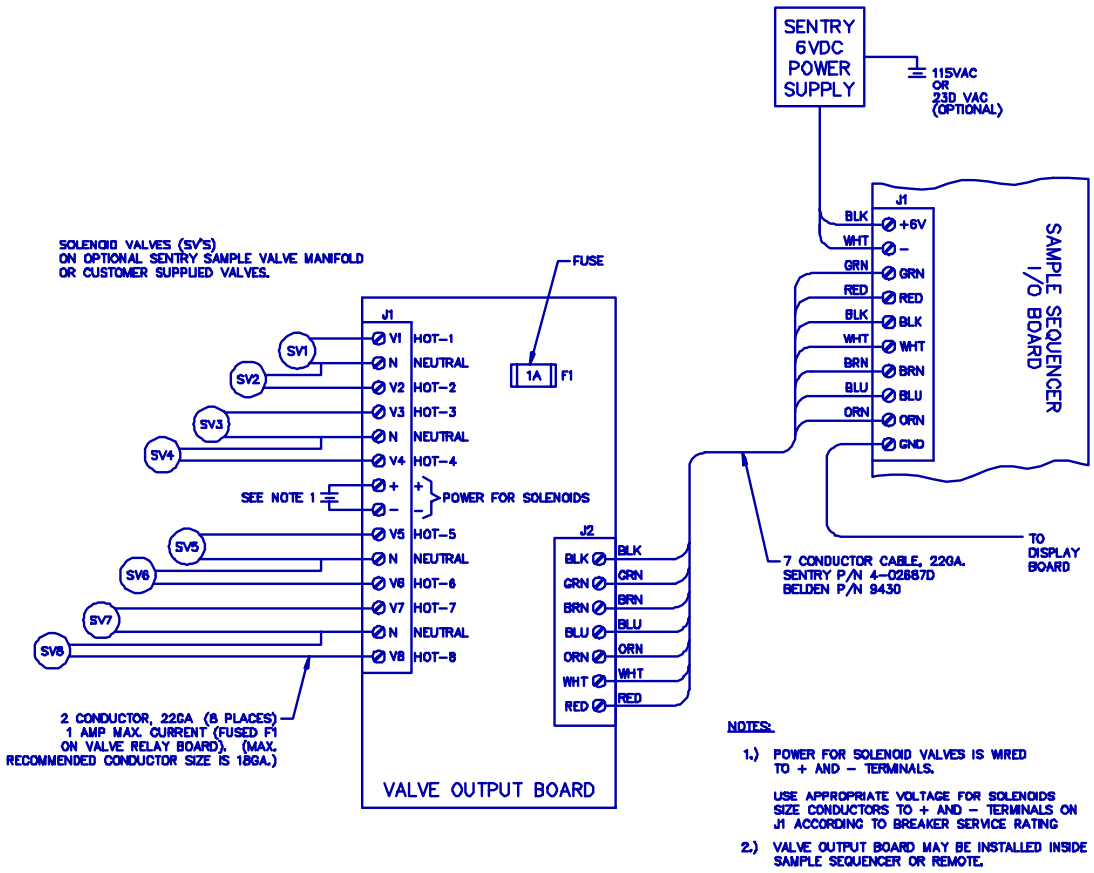


FIGURE 16 - Solenoid Sample Valve Connections

Sample Valve Piping

Proper sample conditioning and sample switching is recommended to obtain a representative sample.
- See Appendix B

Recorder Signal Connections

The Sample Sequencer with optional output boards has the capability of outputting analog signals to recorders. There are three types of optional signal output boards available: Signal Switching output board; 0 - 1 VDC output board; and the plug-in electronic track & hold board. See General Description for more information about these boards. Figure 17 and 18 shows the Sample Sequencer assembly with these board options. ***Note: The signal switching board or 0-1 volt board cannot be used with the plug-in electronic track & hold board.***

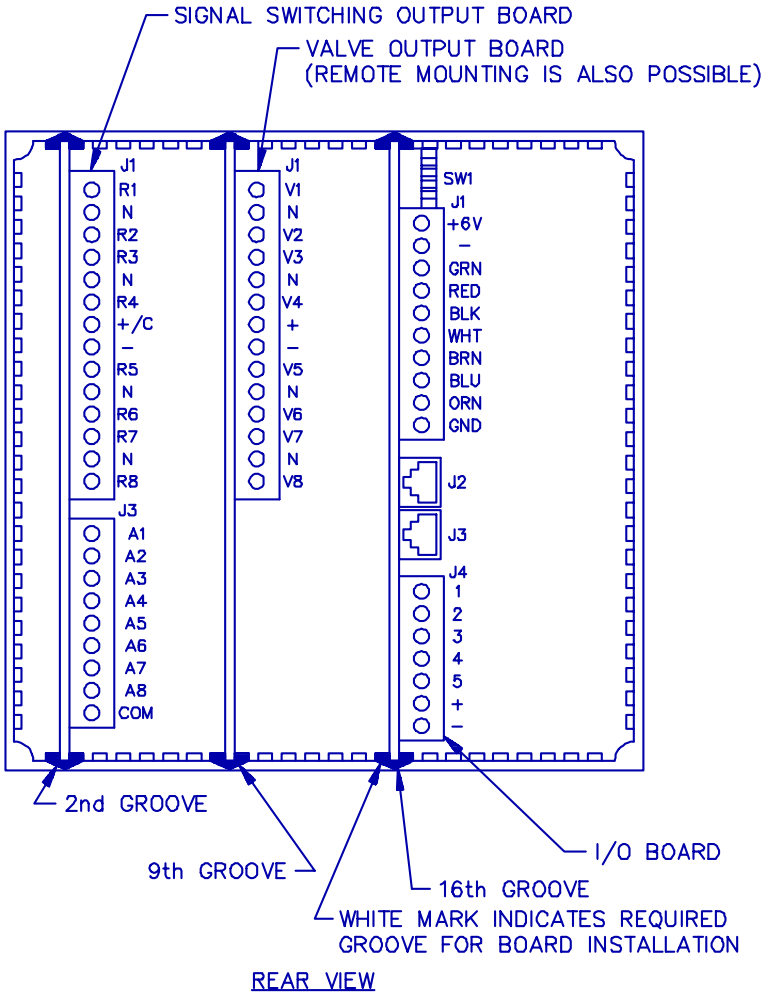


FIGURE 17 - Sample Sequencer Assembly with Signal Switching Output Board (Rear View)

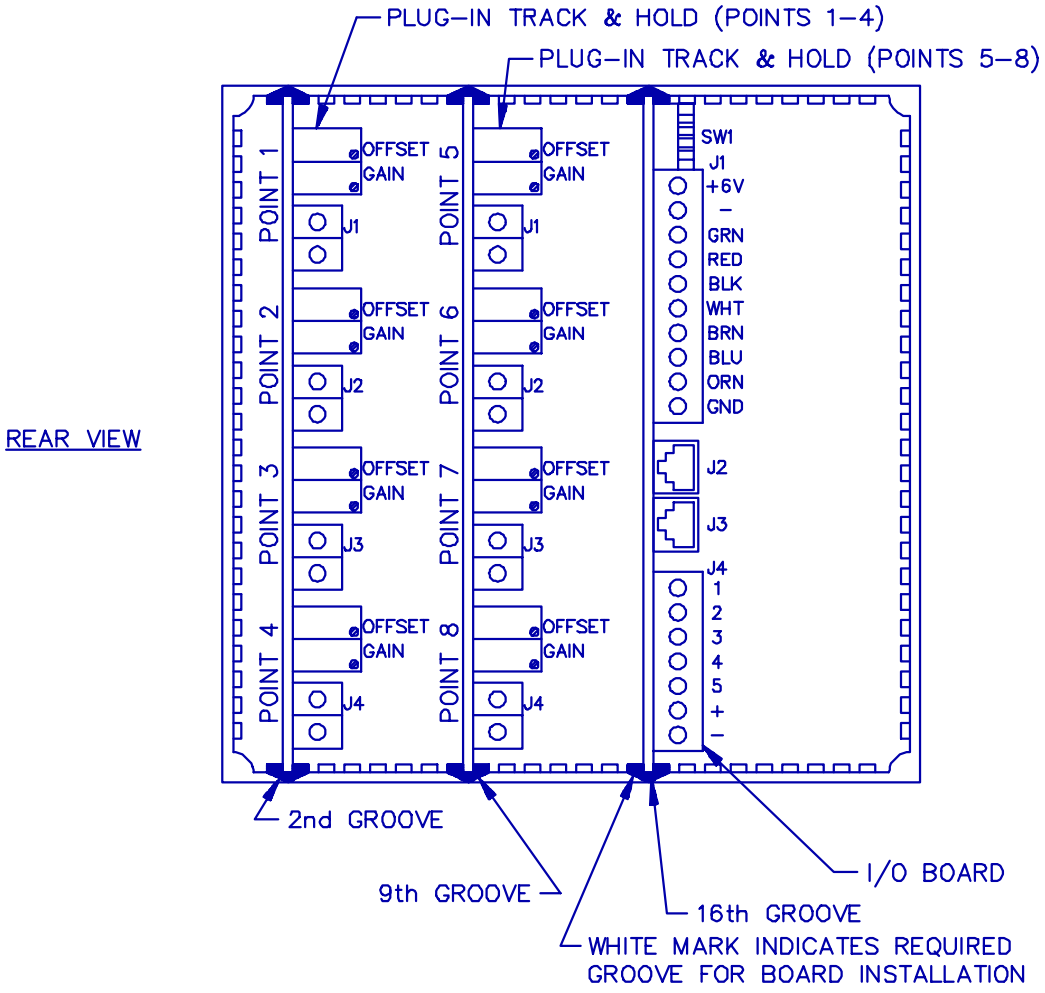


Figure 18 - Sample Sequencer Assembly with Plug-in Track & Hold

Signal Switching Output Board (part number 6-02547C) is used in either of two ways: (1) to commutate, (i.e., switch) an analog signal to eight individual outputs to a recorder or data acquisition system as shown in the connection diagram of Figure 19, or (2) to provide only dry contact closures to a recorder to indicate the current active channel as shown in the connection diagram Figure 20. All wiring to this board may be performed with 22 gauge conductor cable (32 ft. or 10m maximum length) as follows. **CAUTION: Disconnect power to the Sample Sequencer before proceeding.**

Wiring to Switch Analog Signals - Figure 19

1. The analyzer 0 - 20 mA (or 4-20 mA) analog output signal is connected in series to the I/O board and terminals + and - on J1 of the signal switching output board.
2. Connect recorder signals, R1 through R8 on the output board to the corresponding input terminals of the recorder or data acquisition system.
3. Connect one conductor to any one neutral terminal N on the output board to the (-) terminals of the recorder. Jumper the recorder (-) terminals together.
4. Install the signal switching output board in slot marked on the Sample Sequencer enclosure as shown in Figure 17. Install by plugging the board into the corresponding connector of the display board. (**NOTE:** The board should be installed such that board components are on the right side as viewed from the rear.)

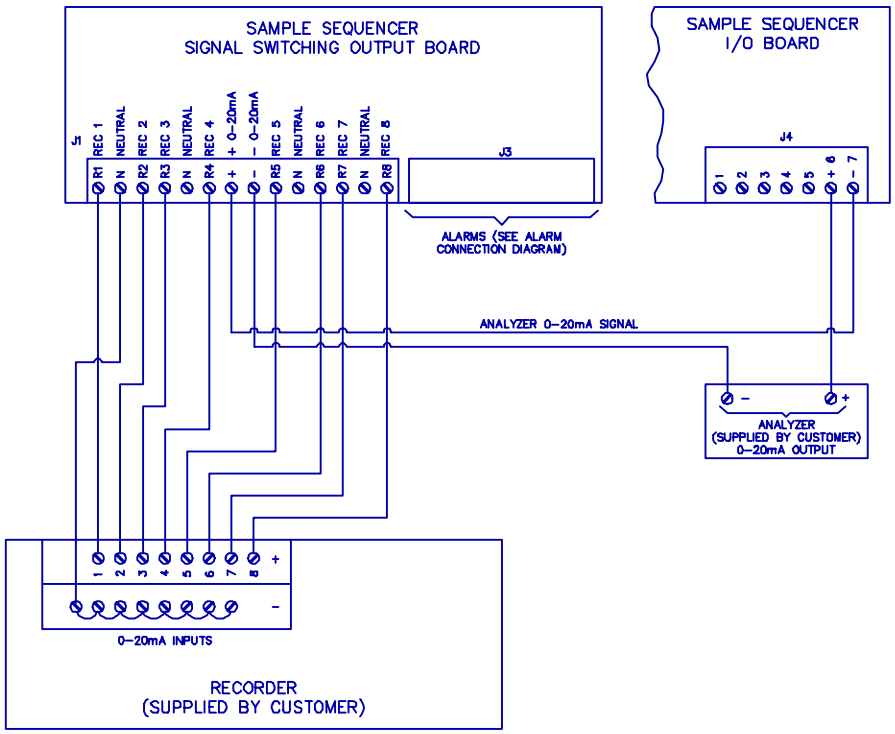


FIGURE 19 - Recorder Connections: Signal Switching Using Signal Switching Output Board

Wiring to Provide Dry Contact Closure - Figure 20

1. The analyzer 0 - 20 mA (or 4-20 mA) analog output signal is connected in series with the Sample Sequencer I/O board and the + and - terminals on the recorder input terminals.
2. Connect terminals R1 through R8 on the output board, to the corresponding input terminals of the recorder or data acquisition system for contact closure indication of sample number.
3. Connect one conductor to terminal C on the output board to a negative (-) terminal on the recorder. Jumper the recorder (-) terminals together.
4. Install the signal switching output board in either of two slot locations marked on the Sample Sequencer enclosure as shown in Figure 17. Install by plugging the board into the corresponding connector of the display board. (**NOTE:** The board should be installed such that board components are on the right side as viewed from the rear.)

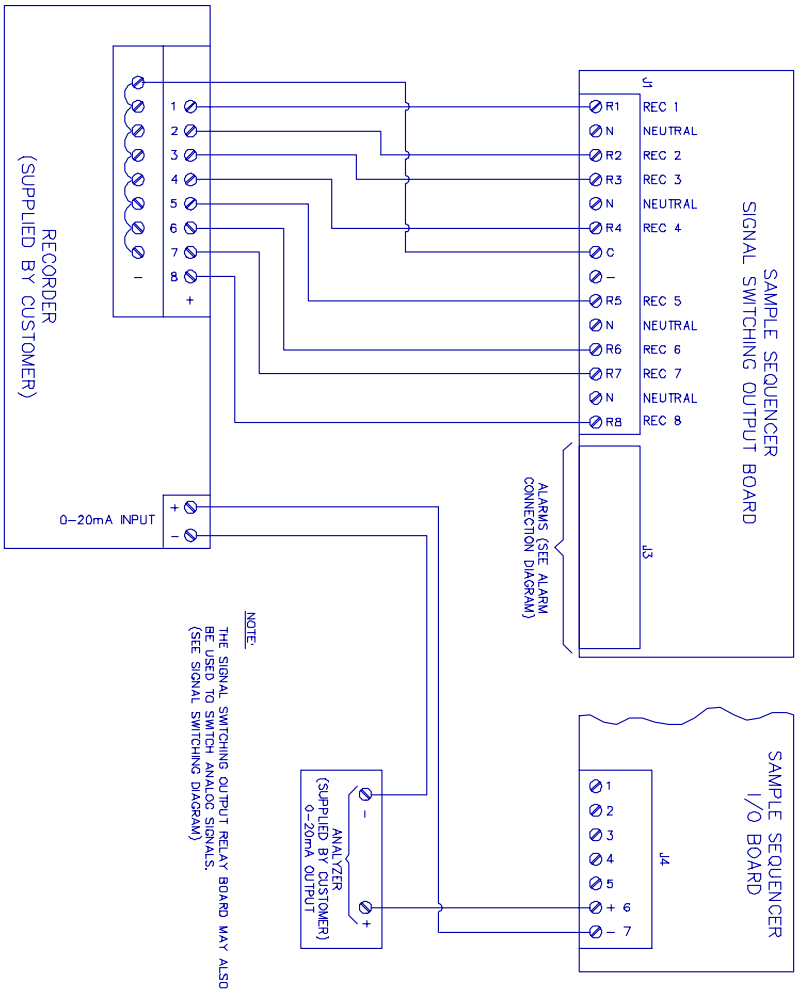


FIGURE 20 - Recorder Connections: Contact Closure Channel Indication Using Signal Switching Output Board

0-1 Volt Signal Output Board (6-02547E) is used to provide an analog signal of 0 to 1 Volt DC indicating the current sample point number which is in Dwell. This optional board is used when the recorder has insufficient channels to record the analog data from sequencing two or more sample streams to one or more analyzers. (The recorder must have minimum two channels plus one extra channel for each extra analyzer.) Figure 21 shows the wiring connections for a system using three analyzers and a four-channel recorder.

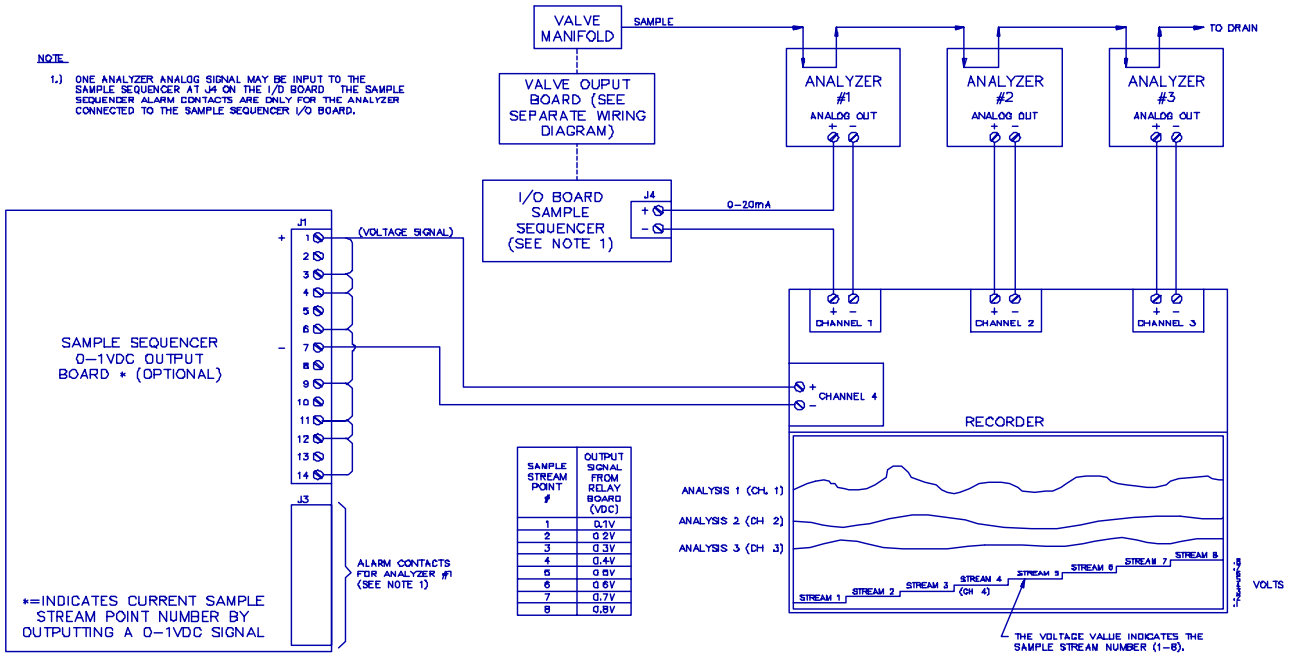


FIGURE 21 - Recorder Connections For One or More Analyzers
Using 0-1VDC Output Relay Board

Wiring to Output 0-1 VDC - Figure 21

1. The 0 -1 VDC signal switching output board should have the jumpers on J1 as shown in Figure 21. Connect the (+) terminal on the output board to the (+) terminal on the desired recorder input channel using 22 gauge conductor. Connect the (-) terminal on the output board to the recorder (-) input terminal. Maximum cable length is 32 ft. (10m).

2A. If using one analyzer: Connect the analyzer (+) terminal to the Sample Sequencer I/O board (+) terminal using 22 gauge conductor. Connect the I/O board (-) terminal to the recorder (+) terminal on the desired input channel. Connect the analyzer (-) terminal to the recorder (-) terminal. If using one analyzer, go to step 3.

2B. If using two or more analyzers: Select one of the analyzers for imputing its signal to the Sequencer. Perform step 2A above. Then, connect the remaining analyzer(s) output signals to the recorder input channels as shown in Figure 21.

3. Install the signal switching output board in either of two locations marked on the Sample Sequencer enclosure as shown in Figure 17. Install by plugging the board into the corresponding connector of the display board. The board should be installed such that board components are on the right side as viewed from the rear.

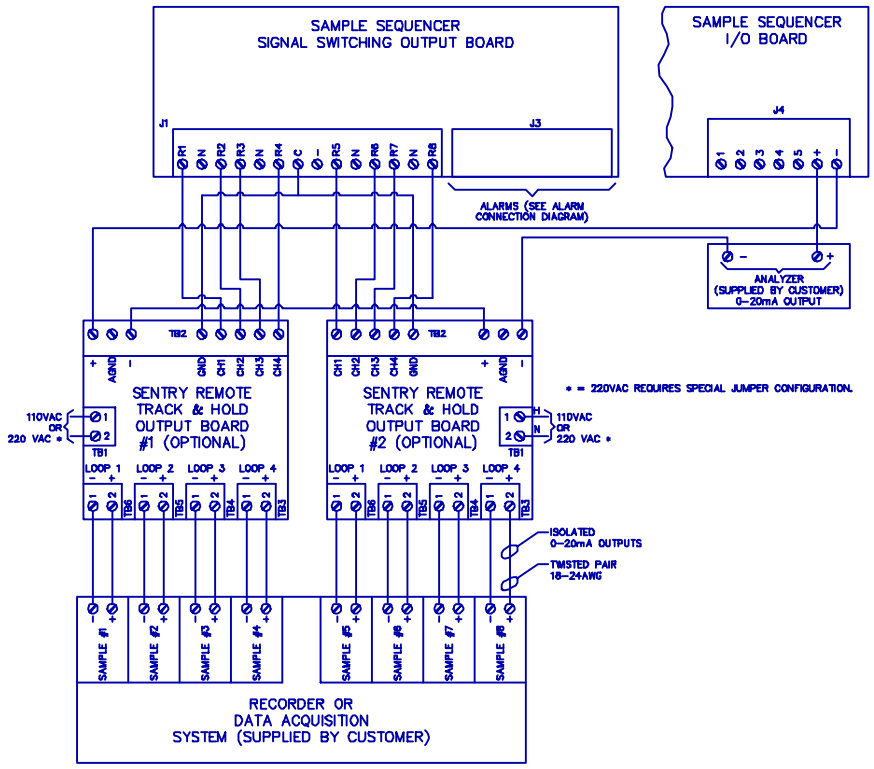


FIGURE 22 - Recorder Connections Using Remote Track & Hold Output Board(s) & Signal Switching Output Board

Remote Electronic Track & Hold Boards (7-00839A) are used in conjunction with signal switching output boards to output individually isolated 0-20 mA or 4-20 mA signals to recorders or other data acquisition systems. The advantage over using the plug-in type is that alarm contacts are now available from the signal switching output board. One may use as many remote electronic track & hold boards as desired. Figure 22 shows how to connect the board.

Wiring to the Remote Electronic track & hold Board - Figure 22

1. The analyzer 0-20 mA analog output signal (or 4-20 mA) is connected to the Sample Sequencer I/O board terminals J4 + and - in series with the electronic track & hold board terminals TB2 - 1 (+) and TB2-2 (-). Use 18-24 AWG cable. (See Appendix H to configure for voltage inputs.)
2. Connect the appropriate J1 terminals on the Sample Sequencer output board to TB2-4 through TB2-8. Use 18 to 24AWG.
3. Connect the loop output terminals TB3, TB4, TB5 and TB6 on electronic track & hold board to the appropriate recorder input channel. Use 18-24 AWG.
4. Connect line power to terminals TB1-H and TB1-N. (The hot terminal is left of neutral.)
   Note: The board is configured for 110/120 VAC. If 220/240 VAC operation is required, follow the Appendix C procedure to configure for 220/240 VAC.

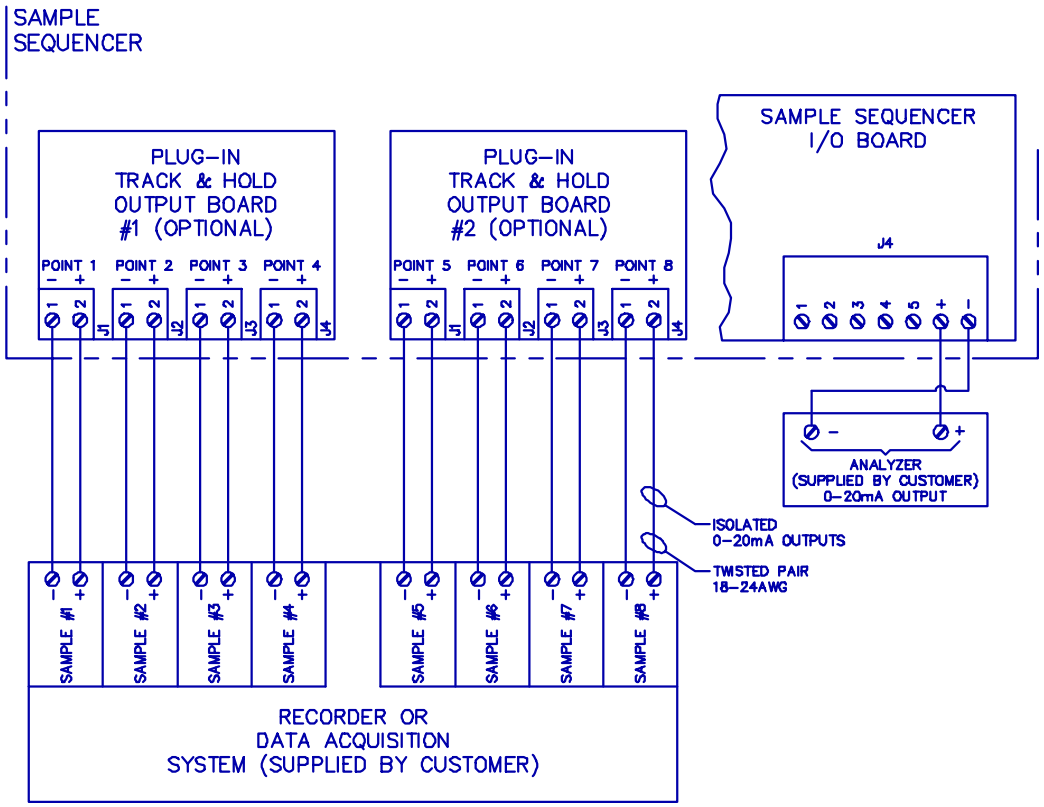


Figure 23 - Recorder Connections Using Plug-in Track & Hold Output Board(s)

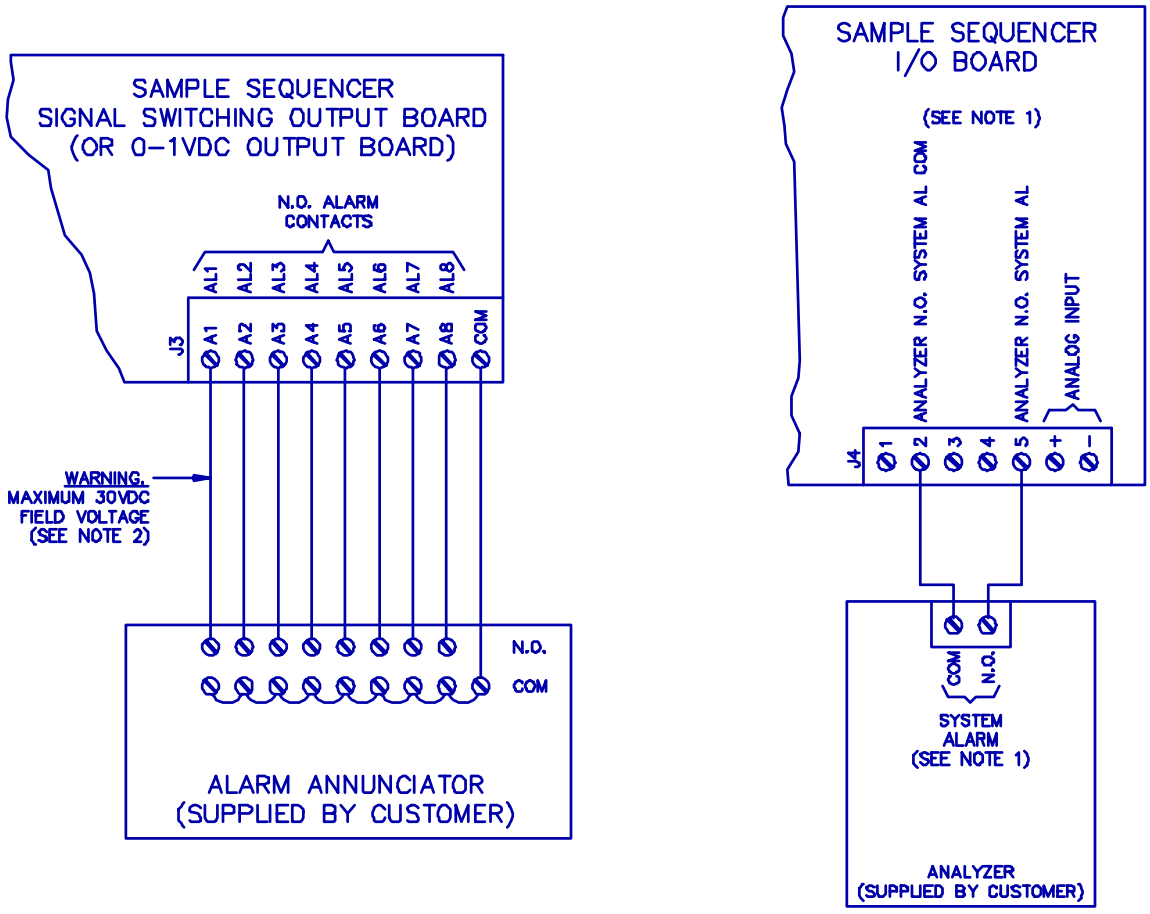
Plug-In Electronic Track & Hold Boards (6-02499E) are installed in Sample Sequencer (See Figure 18) to output individually isolated 0-20 mA signals to recorders or other data acquisition systems. One may use one or two plug-in electronic track & hold boards. Figure 23 shows how to connect the board. **Note: If you are retrofitting a Plug-In Track & Hold to an existing Sequencer in the field, see Appendix G.** The plug-in track & hold may be configured to provide a dual output of one point. (See Appendix F)

Wiring to the Plug-In Track & Hold Board - Figure 23

1. The analyzer analog output is connected to J4+/-Terminal on Sample Sequencer I/O Board. Use 18 - 24 AWG wire.
2. Connect the appropriate point output of plug-in track & hold board to the appropriate recorder or data acquisition system. Use 18 - 24 AWG.
3. If the track & hold circuit card provides a dual point output, see Appendix F.

Alarm Signal Connections

Commutated alarm signals from the Sample Sequencer may be connected to annunciators. **The annunciator may supply maximum 30 volts DC 1A field voltage to the alarm contacts.** An analyzer system alarm may also be connected to the Sequencer. ***Note: Do not connect low or high alarms from the analyzer to the Sequencer.*** Alarm signals in the form of normally open dry contacts are available from the Sample Sequencer when a signal switching or 0-1 VDC signal switching output board is supplied. Follow the below instructions and refer to Figure 24 to connect the alarms from the Sequencer and analyzer. Low and high alarms are programmed in milliamp valve.



NOTES:

1.) THE N.O. ANALYZER SYSTEM ALARM (IF AVAILABLE) SHOULD BE CONNECTED TO THE SAMPLE SEQUENCER I/O BOARD TERMINALS J4–2 & J4–5. THE SYSTEM ALARM INDICATES A MAJOR PROBLEM AFFECTING OPERATION OF THE ANALYZER, i.e., LOSS OF REAGENTS, LOSS OF REAGENT OR SAMPLE PRESSURE, OR POWER LOSS. SYSTEM ALARMS EXCLUDE LOW & HIGH ALARMS. (THE SAMPLE SEQUENCER HAS BUILT–IN INDEPENDENT LOW/HIGH ALARMS.)

NOTE: MANY ANALYZERS DON'T HAVE SYSTEM ALARM CONTACTS. DO NOT CONNECT LOW/HIGH ALARMS TO THE I/O BOARD.

2.) THE ALARM CONTACTS ON SIGNAL SWITCHING BOARDS ARE PROVIDED AS DRY CONTACT CLOSURES. THE ANNUNCIATOR MAY SUPPLY MAXIMUM 30 VOLTS DC 1A FIELD VOLTAGE TO THE ALARM CONTACTS.

IF HIGH VOLTAGE ALARM CONTACTS ARE REQUIRED, CONFIGURE OUTPUT RELAY BOARD TO OUTPUT 6VDC POWER FOR A REMOTE RELAY (CUSTOMER SUPPLIED). SEE APPENDIX A.

FIGURE 24 - Alarm Connections

1. Connect the alarm terminals AL1 through AL8 on the signal switching board to the corresponding annunciator N.O. terminals. Maximum recommended cable length is 32 ft. (or 10 m).

2. Connect the COM terminal on the signal switching board to a common terminal on the annunciator. Jumper the annunciator common terminals together.

3. If the analyzer has a dry contact system alarm, connect it to J4 terminals 2 and 5 on the I/O board in the Sample Sequencer. Do not power these terminals. ***Note: Do not connect analyzer low or high alarms to the Sequencer.***

Starting Up The Sample Sequencer

Upon completing connection of the Sample Sequencer to the analyzer, valves, recorders, etc., as described above, the following should be verified:

1. The plug-in boards (described above) should be snugly connected into the display board.
2. The rear cover should be installed on the Sequencer.
3. The Sample Sequencer is securely mounted.
4. The power may then be turned on. Consult the Operation section of this manual.
5. If there are problems, consult the troubleshooting section of this manual.

MAINTENANCE

Fuses
There are fuses on the Sample Sequencer to protect personnel, wiring and the electronics from excessive current draw. Every board except the display board contains one fuse.

The I/O board fuse is a 3 Amp subminiature 2AG fast blow (Littelfuse 225.003).

The valve and signal switching boards fuse use a 1 amp subminiature 2AG fast blow. (Littelfuse 225.001). The parts may also be purchased from Sentry. See the Spare parts list. **Note: Disregard 500 mA marking on I/O board.**

If a board does not function, check the fuse for continuity to determine if it is defective. Note, the small fuse wire may appear intact; however, it commonly breaks at a spot not visible.

Calibration
Note: The analog circuitry of the Sample Sequencer is calibrated at Sentry prior to shipment. Re-calibration should be performed by properly trained personnel. Refer to the following procedures to calibrate the analog circuits of the Sample Sequencer:

Analog Input Calibration

1. Tools Required: Calibrated milliampere supply and Phillips and flat instrument screwdrivers.
2. Turn off power to the Sample Sequencer.
3. Remove the existing analog input wires. See Figure 7 for board and terminal locations.
4. Snap off the front bezel on the Sample Sequencer by hand or lightly with a small flat screwdriver.
5. Remove the four corner mounting screws. Use a small flat screwdriver to carefully pry out the display board assembly and connected boards approximately one inch. The calibration potentiometers are visible on the left edge (from front of Sequencer) of the display board.
6. Verify the boards are still plugged into the display board.
7. On the rear of the I/O board, turn the DIP switch SW1-3 on. This switches the unit into the calibrate mode.
8. Turn on power to the Sample Sequencer.
9. Disconnect the input to the Sequencer and examine the ANALOG mA display on front of the Sample Sequencer to verify 0 mA. Using a small flat instrument screwdriver, adjust the offset potentiometer (R5) until the display reads 0 mA. (The offset pot is the top pot visible on the left edge of display board.)
10. Input 20 to mA to the Sample Sequencer and examine the ANALOG mA display on front of the Sequencer. Adjust the gain potentiometer (R6) until the display reads the same input 20 mA. (The gain pot is the bottom pot on the left edge of the display board.)
11. Repeat steps 9 and 10 until an accurate calibration is obtained.

12. If the signal switching output board is installed, one may check the recorder calibration on each individual point by repeatedly pressing the "NEXT" key on the Sequencer while in the calibrate mode. This will verify recorder operation with the milliampere calibration signal on each point.
13. Turn off power to the Sample Sequencer.
14. Slide the display board and interconnected boards back into the enclosure. Replace the four screws and bezel.
15. Remove the calibrated power supply and reconnect the analog input signal wires.

16. Turn the DIP switch SW1-3 to off. This puts the Sequencer back into the normal operation mode.
17. Turn power on. Analog input calibration is complete. Push START/RESET to restart the Sample Sequencer.

Analog Output Calibration of the Remote Electronic Track & Hold Board (7 -00839A)

Note: Sentry calibrates the Track and Hold card prior to shipping.

Tools Required:

A calibrated milliamp power source with digital display, calibrated milliamp meter and jumper wires are required to calibrate the card. The recommended calibration procedure is:

1. Disconnect power to the Sample Sequencer and the Track and Hold card. Disconnect existing wires to the Track and Hold board.
2. Jumper the four input channel terminals (CH1, CH2, CH3, CH4 on TB2) together to the ground terminal (GND on TB2). See figure C1 in Appendix C.
3. Connect a calibrated milliamp source (0-20 mA) up to the (+) and (-) terminals on TB2.
4. Connect 110-120 VAC to TB1. (Use 220 VAC if configured such.)
5. Connect a calibrated milliamp meter to LOOP1 (TB6 (+) and (-) terminals).
6. Input approximately 18-19 mA. Adjust the GAIN potentiometer (R43 for loop 1) until the output signal measured by the meter matches the input signal.
7. Input approximately 4mA. Adjust the OFFSET potentiometer (R41 for loop 1) until the output signal measured by the meter matches the input signal.
8. Repeat steps 5 through 6 until GAIN and OFFSET provide the correct signals.
9. Repeat steps 4 through 7 for LOOP2 (TB5), LOOP3 (TB4) and LOOP4 (TB3). The respective GAIN and OFFSET potentiometers for these loops are adjacent to the corresponding LOOP terminal block.
10. Calibration is now complete. Disconnect power and remove your meters and jumpers.
11. Reconnect wires to the Track and Hold card.

Analog Output Calibration of the Plug-in Electronic track & hold Board (Track & Hold)

Note: This calibration should occur ***after*** calibrating the analog input circuit on I/O circuit board.

1. Tools required: Calibrated milliampere power supply, multimeter with milliampere measurement capability, Phillips and flat instrument screwdrivers.

2. Program the cycle time for one (1) second.
3. Turn off power to the Sample Sequencer.
4. Disconnect the existing analog input wires from the I/O board (at J4 on (+) and (-) terminals) and connect a calibrated milliampere power supply.
5. On the rear of the I/O board, turn the DIP switch SW1-3 on. This switches the unit into the calibrate mode.
6. Connect a milliamp meter to the (+) and (-) terminals of the desired output point on the electronic track & hold board.
7. Turn power to the Sample Sequencer on. Push the NEXT button to display desired point.
8. Input 4 mA with the milliampere power source. Adjust the offset pot on track & hold circuit board on the point being calibrated until the meter reading matches the sequencer analog mA display.
9. Input 20 mA with the milliampere power source. Adjust the gain pot on the track & hold board point being calibrated until the meter reading matches the Sequencer Analog mA display.

10. Repeat steps 7 and 8 until point is calibrated.
11. Repeat steps 5 through 9 for the remaining points on the track & hold board(s).
12. The recorder calibration may also be checked by repeatedly pressing the "NEXT" key on the Sequencer. This will verify recorder operation with the milliampere calibration signal.
13. Turn off power to the Sequencer. Remove the milliampere power source and meter.
14. Turn DIP switch SW1-3 off. This switches the Sequencer back to normal mode of operation.
15. Turn power on. Analog output calibration is complete. Re-program cycle time for desired amount. Push START/RESET to restart the Sample Sequencer.

TROUBLESHOOTING

Troubleshooting Guide

Symptom	Possible Problem(s)	Remedy
Display doesn't light	Power	1. Verify power supply outputs 6-9 VDC. 2. Verify polarity is connected correctly to I/O board.
	Board connection	1. Verify I/O board is snugly connected into I/O board. 2. Verify I/O board component-side is on right side from rear view.
	Fuse on I/O board	1. Remove F1 (3A) on the I/O board and test for continuity. Replace if defective.
Incorrect ANALOG mA	Analyzer signal	1. Verify the input signal from analyzer is 0-20 mA.
	Polarity	2. Verify the analog signal polarity is correctly connected to the I/O board terminals (+) and (-) on J4.
Incorrect valve operates	Wiring	1. Verify the interconnected cable (8 conductor) is correctly connected from the I/O board terminals and the valve relay board.
Valves don't operate	Valve power	1. Verify power was brought to the valve relay board J1 terminals labeled (+) and (-). **Danger:** Disconnect power before checking this!
	Fuse	1. Check F1 fuse on the valve relay board. Replace with 1A fuse if defective.

Troubleshooting Guide

Symptom	Possible Problem(s)	Remedy
Sample Sequencer times out and goes into off.	Mode selection	1. Verify the DIP switch 3 on SW1 of I/O board is set properly.
	System Alarm	1. Is the analyzer alarm light on the Sequencer on? If so, an analyzer system alarm occurred on eight consecutive sample points. Check your analyzer. Also verify wiring to Sequencer is correct. See I/O board connections and alarm connections. Note: The system alarm terminals on sequencer are not for low or high alarms from analyzer.
	Wiring	1. Verify the analyzer end-of-batch signal is properly wired to I/O board.
	Timing	1. Increase the cycle time setting to allow more time for analyzer to complete batch.
	Analyzer	1. Verify analyzer is correctly configured to output end-of-batch signal.
Only ANALOG mA can be displayed	Calibrate Mode	1. Check DIP switch 3 on SW1 of I/O can board. It should normally be Off.
Sequencer doesn't recognize end-of-batch signal from analyzer	Mode Setting	1. Verify DIP switch 4 on SW1 of I/O board is ON for batch mode operation.
	Wiring Analyzer	1. Verify wiring to I/O board is correct. 2. Verify analyzer is configured to output end-of-batch signal.

COMPUTER COMMUNICATIONS

The Sample Sequencer contains a communication port allowing it to send and receive any information and accept operating instructions from a remote computer. Many other Sentry controllers can be on the same line in a network. The connected computer can process the information for display, historical records, annunciation and communication to other systems.

Included in the Sample Sequencer is a complete RS-485 serial communication system requiring a single twisted pair cable. Up to 16 or more Sample Sequencers and/or Sample Sentry controllers can be connected via a single twisted pair line to a computer with a RS-485 communications card. Simple RS-485 to RS-232 converters are available if required.

Sentry offers a software program, SEQUENCE™ to conveniently provide network communications with a PC.

SEQUENCE Monitor Program:
For IBM compatible PCs, this program controls and maintains the complete status of up to 16 sequencers and on each Sequencer all 8 sample points. A programming and control screen allows easy editing of control data and testing of each function, and for each connected Sequencer.

The input data is stored in computer files so that a historical record is kept. The program can present this data on screen in tabular or graphical form or it can be printed. More details are available in the Sequence™ Monitor manual.

Communication Protocol:

The following capabilities are available at the computer:

- Complete remote programming of alarms and times, but not station number.
- Remote on/off setting of sample points. This also resets alarms. If all samples are turned off, Sequencer goes to "OFF" mode.
- Remote start/reset.
- Receive timing set values.
- Receive low and high alarm set values.
- Receive all current Analog mA values.
- Receive status:

  Mode status
  All alarms
  Active input and output channels
  Current Analog mA value

A low start bit, eight data bits and one high stop bit are used. A computer transmission should always be preceded by at least two rubouts. 2400 baud rate is used. The most significant four bits of each data byte is a designator as follows:

0001 nnnn Data
0011 nnnn Command
1000 nnnn Station numbers, Sample Sequencer
1111 1111 Rubout

Unused numbers are reserved for station numbers of other controllers.

Each station reads every valid byte sent by the computer or another station. The station number in 0 to 7 form is OR'd to 10000000B to compare with the communication bytes being sent, and when there is a match, the sequencer takes the next byte as a command to perform some function for the central computer. Each Sequencer is a "slave" and does not originate.

Commands to the Sample Sequencer:

0011	0000B	Send 8 high alarm values
0011	0001B	Send 8 low alarm values
0011	0010B	Send CYCLE, DELAY, DWELL set times
0011	0011B	Send CYCLE, DELAY, DWELL actual times
0011	0100B	Send A and D values 1 to 4
0011	0101B	Send A and D values 5 to 8
0011	0110B	Send status
0011	1000B	Receive 8 high alarm values
0011	1001B	Receive 8 low alarm values
0011	1010B	Receive CYCLE, DELAY, DWELL set times
0011	1011B	Receive status
0011	1100B	Start/reset function

SERVICE

Factory Assistance
Sentry Equipment Corp has been in the forefront of steam and water sampling equipment technology for over 70 years. Sentry has always been recognized as the market leader in new sampling technology and in exceptional customer support.

Please, do not return any equipment before discussing your application problem with a Sentry representative and obtaining a Return Authorization.

Sentry Equipment Corp has a complete staff of trained Service Department associates to assist customers with any problems. Call Sentry at 262/567-7256 (Fax: 262/567-4523) to request a service representative.

SPARE PARTS LIST

Description	Sentry Part No.
Sample Sequencer circuit board assemblies:	
Display board	6-02499A
I/O Board	6-02547F
Signal Switching Output Board	6-02547C
0-1VDC Output Board	6-02547E
Valve Output Board	6-02547G
120VAC Remote Electronic Track & Hold (4 channels) with Enclosure	7-00839A
220VAC Remote Electronic Track & Hold (4 channel) with Enclosure	7-00839B
Plug-In Track & Hold Board	6-02499E
Dual Output Plug-In Track & Hold Board	6-02499F
Membrane switch assembly (includes aluminum plate)	6-02547A
Sample name tag	
*Fuse, 1 amp (used on valve output and signal switching boards)	4-02055B
*Fuse, 3 amp (used on I/O circuit board)	4-02055C
*Fuse, 1 amp (used on remote track & hold board)	4-05086A
Enclosure, Sample Sequencer	
Enclosure for Remote Valve Output Board	2-04047F
Power Supplies (6VDC for Sample Sequencer)	
120 VAC/60 Hz to 6 VDC (standard-with no plug-in T/H)	2-04173D
220 VAC/50 Hz to 6 VDC (European Plug-used with no T/H)	2-04173A
120 VAC/60 Hz to 6VDC, 3.5A (used with plug-in track & hold)	2-04173E
220 VAC/50 Hz to 6 VDC, 3A (used with plug-in track & hold)	2-04173F

*Recommended spare parts

ACCESSORIES

Description	Sentry Part No.
Remote Valve output board with enclosure	6-02547D
Cable to connect Remote Valve Output board to Sequencer (specify length)	4-02687D
NEMA 4X stainless steel mounting plate for Sample Sequencer	6-02547B
SEQUENCE™ PC program for computer communications	6-02627A
RS-485 to RS-232 Converter	6-02627B
Manifolded Sampling Valves: Consult Sentry representative	
Sentry Sample Coolers: Consult Sentry representative	
Sentry Back Pressure Regulator (20 psi)/Relief Valve (BPR/RV)	7-00868A
Sentry Flow Indicator with control valve (FICV), 580 cc/min	6-02671D
Sentry Flow Indicator with control valve (FI), 1600 cc/min	6-02671B
Sentry VREL (Variable Pressure Reducing Element valve)	7-00744A
Filter, 1/4" Compressor-connecting	4-00484K
Replacement Filter Element, 40 mesh	4-00361L

WARRANTY

1.0 **Introduction** The purpose of this manual is to provide installers, owners & servicemen with procedures for carrying out the Sentry Warranty. By becoming familiar with this manual, you will keep misunderstanding between your organization and the factory to a minimum and prevent delay in receiving the final adjustment. This manual supersedes all previous manuals and bulletins regarding Warranty & Procedure and is subject to change without notice.

Direct to: Warranty Claims Administrator, Sentry Equipment Corp, PO Box 127, Oconomowoc, WI 53066, 262-567-7256; (a) questions regarding the procedures covered by this manual; (b) request for a Return Authorization Number.

2.0 **Warranty** Seller warrants products manufactured by it and supplied hereunder to be free from defects in materials and workmanship for a period of twelve months from date of shipment. If within such period any such products shall be proved to Seller's satisfaction to be defective, such products shall be repaired or replaced at Seller's option. Seller's obligation and Buyer's exclusive remedy hereunder shall be limited to such repair and replacement and shall be conditioned upon Seller's receiving written notice of any alleged defect within 10 days after its discovery and, at Seller's option, return of such product to Seller, ex-works Sentry's factory.

The foregoing warranties are exclusive and in lieu of all other express and implied warranties except in title, including but not limited to implied warranties of merchantability and fitness for purpose. Seller shall not be subject to any other obligations or liabilities whatsoever with respect to products manufactured or furnished by it, or any undertakings, acts or omissions relating thereto.

3.0 **Warranty Conditions & Limitations** This Warranty shall not apply to any Sentry product which, in the opinion of Sentry Equipment Corp, has been (a) altered or repaired in a manner affecting the efficiency of performance of the unit or (b) incorrectly installed or operated or (c) damaged in shipment or (d) damaged by flood or fire or (e) if the serial number is missing, altered or defaced.

The owner shall be responsible for maintenance of his equipment. Wear or damage caused by lack of normal maintenance or by misuse of the equipment shall not be considered as defective workmanship and material.

Sentry reserves the right to make product design changes or improvements without notice and without imposing any obligation upon itself to install these changes or improvements on its products previously manufactured.

This warranty is for the sole benefit of the original purchaser and is not transferable unless agreed to in writing by Sentry Equipment Corp.

4.0 **Receiving Shipments (including loss or damage by transportation)** It is the customer's responsibility to check for missing cartons and sign of damage to cartons. If found, customer should note missing and/or damaged cartons on the delivery receipt and have delivery receipt signed by the representative of the transportation company. If unpacking discloses concealed damage from rough handling, the customer should request a concealed damage inspection from the transportation company.

The Sentry Traffic Department will aid your organization in any claim proceeding for shortages or damages in shipment, but it is the receiver's responsibility to file claim with the carrier for damage or loss.

5.0 Customer Actions to Get Replacement Parts for Equipment During the Warranty Period

If your serviceman feels a failure was the result of defective material or factory workmanship under terms of Sentry's Standard Warranty; take the following actions:

5.1 Contact Factory, Warranty Claims Administrator, for Return Authorization Number.

5.2 Return the defective parts FREIGHT PREPAID to: Sentry Equipment Corp, 856 East Armour Road, Oconomowoc, WI 53066.

5.3 Include a description of the problem or failure. This helps Sentry with the processing of the Warranty Claim. The Return Authorization Number must be included or the shipment will be refused at Sentry.

5.4 Information to provide with the return of the Sentry product includes:

- Return Authorization Number
- Date
- Contact Name, Company and Company Address
- Telephone and fax number
- Your P.O. Number, date purchased and months in operation
- Model Number and serial number of item being returned
- Description of the problem you experienced with the equipment

Important Notes:

1. Completely describe the problem experienced or the warranty defect you believe exists. It is especially important that the customer show their Return Authorization Number, otherwise, the Sentry factory cannot identify the customer's claim and his returned parts and final adjustment of the claim will be unnecessarily delayed. The customer may obtain a Return Authorization Number by calling the Warranty Claims Administrator at Sentry Equipment Corp, 262-567-7256.

2. The factory will not process warranty claims until customer has properly accomplished the actions of paragraphs 5.1, 5.2, 5.3 and 5.4.

3. The factory decision regarding the equipment failure will be based on your serviceman's report and our inspection of the returned parts. The Sentry Factory may accept the entire claim, a part of the claim or none of the claim if our inspection of returned parts proves the failure was for reasons other than defective material or factory workmanship.

Appendix A

Configuring the Sample Sequencer to Output 6 Volt DC on Alarm Contacts of Signal Switching Output Board

The Sample Sequencer may be configured to output, (i.e., source), unregulated 6 VDC on the alarm contacts of the signal switching or 0-1VDC output boards if desired. This can be used for applications where remote relays or other devices must be powered for alarm annunciation. This modification may be necessary because the signal switching output board alarm contacts should not be powered above 30 VDC and 1A.

The unregulated 6 VDC can power a remote relay coil used to switch a high voltage signal.

Procedure to Configure the Sample Sequencer to Output 6 VDC on Alarm Contacts

1. Disconnect power from the Sample Sequencer and remove the I/O board.
2. Cut jumper W1 off from the I/O board. (Refer to Figure 7 for location of W1.)
3. Install a jumper in W2 and W3.
4. Insert the I/O board back into correct slot (see Figure 17) of Sample Sequencer.
5. The unit is now ready to operate. Note, a signal switching output board or 0-1 VDC output board must be used to obtain the 6 VDC alarm signal.

Appendix B

Recommended Piping for Sample Sequencer System

It is recommended proper sample conditioning and flow control be maintained to obtain representative samples. The Electric Power Research Institute (EPRI) guidelines for representative sampling recommend maintaining constant and continuous sample flow in sample lines. In addition, it is recommended the sample be cooled to 77 F (25 C) temperature prior to analysis. (*Note*: Some analyzers may recommend a different sample temperature be used to accelerate the analysis process.) Appropriate sample coolers or heaters may be required. Consult the pressure and temperature specifications for your specific analyzer and sampling system. Figure B1 shows the recommended sample conditioning piping and instrumentation diagram (P & ID) when switching streams with the Sample Sequencer.

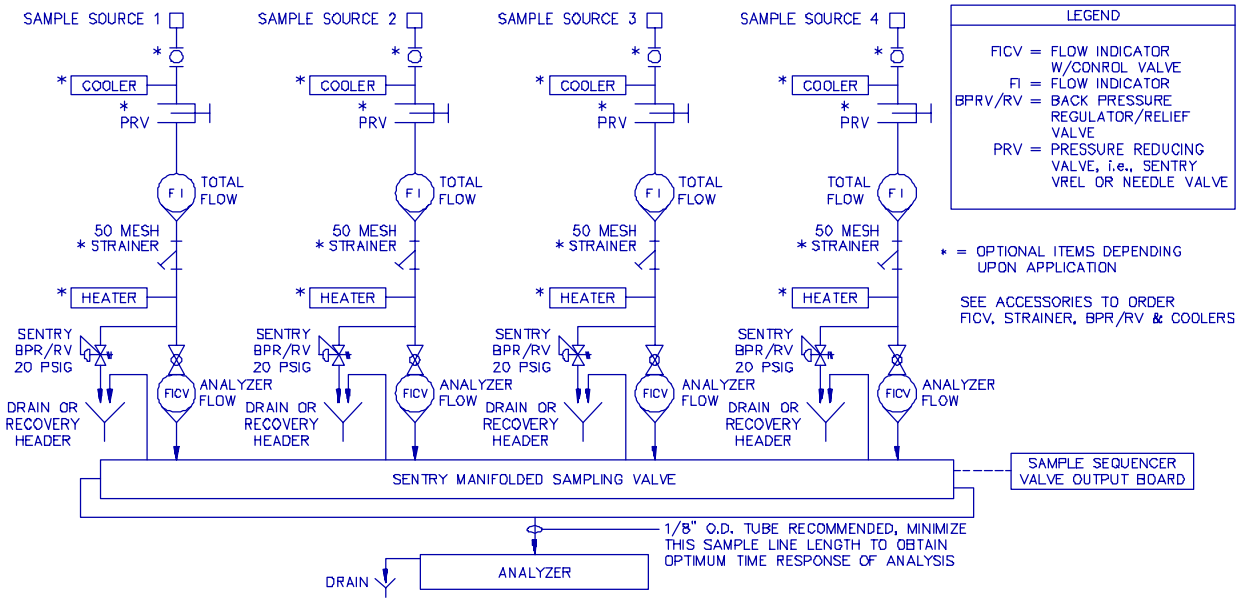


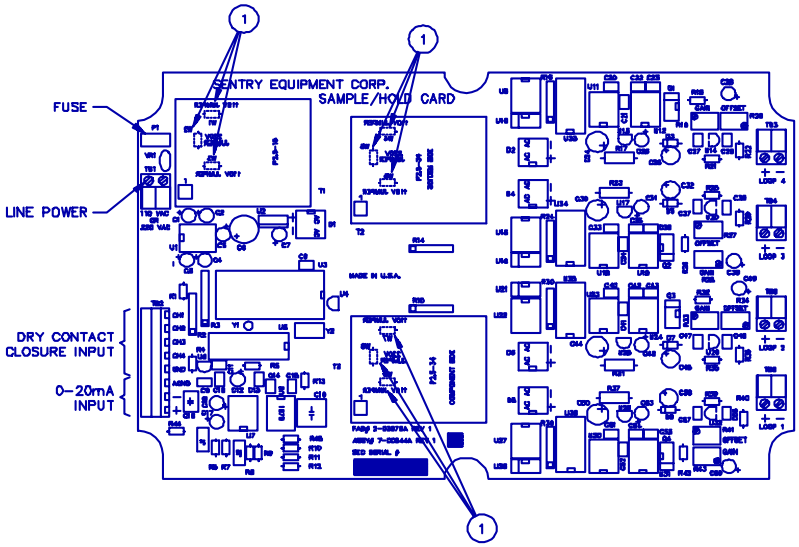
Figure B1 - Recommended Sample Conditioning
for Switching Streams to an Analyzer

Appendix C

Procedure to Configure Remote Electronic Track & Hold Board for 220/240 VAC Operation

The board is factory shipped as 110/120 VAC. Perform the following steps to convert the board for use with 220/240 VAC.

1. Remove the zero-ohm resistor jumpers at W1, W3, W4, W6, W7 and W9 on solder side of the remote electronic track & hold board. Refer to Figure C1.
2. Install jumpers at W2, W5 and W8 on solder side. Use zero-ohm jumpers or 22 AWG insulated wire.



NOTES:

(1) INSTALL CORRECT JUMPERS FOR PROPER VOLTAGE MODE. DEFAULT ASSEMBLY VOLTAGE IS 110V. AS A SECONDARY OPERATION, INSTALL JUMPERS ON SOLDER SIDE OF BOARD. MAKE SURE LEAD LENGTH OF JUMPERS DO NOT PROTRUDE THROUGH BOARD AND CONTACT TRANSFORMER.

T1, T2, AND T3 JUMPER INSTALLATION 110V OPERATION.
- T1 – JUMPER INSTALLED IN W1 AND W3 OMIT JUMPER IN W2.
- T2 – JUMPER INSTALLED IN W4 AND W6 OMIT JUMPER IN W5.
- T3 – JUMPER INSTALLED IN W7 AND W9 OMIT JUMPER IN W8.

T1, T2, AND T3 JUMPER INSTALLATION 220V OPERATION
- T1 – JUMPER INSTALLED IN W2 OMIT JUMPERS IN W1 AND W3.
- T2 – JUMPER INSTALLED IN W5 OMIT JUMPER IN W4 AND W6
- T3 – JUMPER INSTALLED IN W8 OMIT JUMPER IN W7 AND W9.

FIGURE C1 - Remote Electronic Output Board Arrangement

Appendix D

Instructions to Operate a Hach Series 5000 Analyzer with a Sample Sequencer

The Sample Sequencer may be operated with a Hach Series 5000 analyzer. The Series 5000 instruments operate in batch-mode style and require the appropriate configuration for use with the Sample Sequencer. Hach 5000 analyzers have special features which provide a contact closure at the end of the batch. This is called the Mark End of Measurement contact closure. The contact closure causes the Sample Sequencer to advance the sample point number. See Batch Mode operation description in this manual for more information.

Figure D1 illustrates how to connect the Sample Sequencer I/O board to a Hach Series 5000 analyzer. The Hach 5000 analyzer must be configured properly to operate with the Sample Sequencer. The analyzer should be configured to output a recorder signal of 4-20 mA. Further, the analyzer must be programmed to use relay #3 and relay #4 for System Alarm and End-of-Measurement contact closure indications, respectively. Consult the Hach analyzer manual for information about configuring the Recorder output to 4-20 mA and the System Alarm to relay 3. The following procedure describes how to configure the End-of-Measurement contact closure on the Hach 5000.

Configuring the Series 5000 (Catalog No. 60000-XX through 60004-XX) for MARK END OF MEASURE on Relay 4

1. Remove the front cover of the control module. Move the No. 1 DIP switch on SW1 to the ON position. This will enable the Extended Diagnostic menu. (Switch SW1 is an 8-switch DIP located near center of circuit board.)

2. Return to the front of the control panel and press the TEST key. Using the NEXT key, scroll through the diagnostic menu to MARK END OF MEAS. Then, press ENTER and select ENABLE with the NEXT key. Then, press ENTER. This will activate the MARK END OF MEASURE contact closure.

3. Turn OFF switch No. 1 on switch bank SW1 of the circuit board. This will return the analyzer to normal operation but leave the MARK END OF MEASURE function enabled. *Note: This procedure will have to be repeated if a cold start is performed.*

4. Reassign alarm 2 to relay 2 by the following: Press SET UP key. ALARMS will appear. Press ENTER. Then, scroll with the NEXT key to RELAY CONFIG and press ENTER. Scroll to ALARM 2 with the NEXT key and then press ENTER. Scroll with the NEXT key to RLY 2 and press ENTER.

5. Assign relay 4 to mark end of measure by the following: Press SETUP key on the control module. ALARMS will appear. Press ENTER. Then, scroll with the NEXT key to RELAY CONFIG and press ENTER. Scroll to MARK END OF MEAS and press ENTER. Note: MARK END OF MEAS will not appear unless it has been properly activated per the above steps. Scroll with the NEXT key to ALARM 4 and press ENTER. This will assign the alarm 4 relay to mark the end of measurement with a contact closure. The contact closure makes the Sample Sequencer advance to the next sample point.
6. Verify the switches (SW1) on Sample Sequencer I/O board are positioned per Figure D1.

Older Hach Series 5000 Analyzers

If you have an analyzer with a catalog model number 5000X-XX, contact Hach Service Dept. at 1-800/227-4224 regarding using the Sample Sequencer with your analyzer. An updated software EEPROM may be required to operate correctly with the Sample Sequencer.

If you have an analyzer with a catalog model number 5500X-XX, configure your unit as follows:

Model 5500X-XX Configuration

1. The wiring is different for the model 5500X-XX then shown in Figure D1. The changes are: (a) Connect the Sample Sequencer I/O board terminals J4-3 and J4-4 to the Hach terminals labeled NO and COM on ALRM 2. (b) Connect the Sample Sequencer I/O board terminals J4-2 and J4-5 to the Hach terminals labeled NO and COM on SYS ALRM.

2. Open the control module door and loosen the screw to allow access to the rear of the display board. Remove the back cover.

3. Turn ON the #1 DIP switch (S1) by pressing it. This puts the analyzer in the Extended Diagnostic menu.

4. Press the TEST key.

5. Using the NEXT key, scroll through the diagnostic menu to "MARK END of MEAS", then, press ENTER. This will cause the number 2 alarm contact to close at the end of each analysis cycle. The Series 5000 now provides a contact closure to advance the Sample Sequencer to the next sample point each time alarm 2 contact closes. The alarm 2 contact can no longer be used for an alarm signal.

6. After pressing ENTER, return the #1 DIP switch (S1) to the OFF position. Replace the cover and close the meter panel. This returns the analyzer to normal operation. *Note: If a "cold start" is initiated or the backup battery fails during a power failure, you must reset the Mark End of Meas as outlined above.*

7. Verify the switches (SW1) on Sample Sequencer I/O board are positioned per Figure D1.

Recommended Sample Sequencer Timing Settings

It is recommended the following times be programmed into the Sample Sequencer when using the Hach Series 5000 analyzers:

Cycle Time..... 59:59 minutes [1]
Delay Time..... 00:02 seconds minimum
Dwell Time.....00:30 seconds for 8.8 or 15 minute Hach measurement cycle time

Reference the Programming section of this manual for instructions about programming the Sample Sequencer.

Note, that if the Hach 5000 does not issue an End-of-Measurement contact closure before cycle time counts down to zero, the analyzer alarm light on the Sample Sequencer annunciates and the Sequencer turns OFF. This is the reason for the above large cycle time recommendation.

[1] The cycle time is programmed significantly longer than actual analyzer batch analysis duration in order to allow sufficient time for the 15 minute auto-calibration to occur without the Sample Sequencer timing out. See the Hach manual for instructions about making the Hach perform auto-calibration on a regular basis.

See batch mode timing description, "Timing Considerations for Batch Mode" in the operations section of this manual for additional description of timing.

NOTES:

1) Program Hach analyzer to output 4-20 mA by selecting appropriate DIP switch on the Hach Microprocessor board in the Hach control unit. Consult Hach manual.
2) Program Hach analyzer to output system alarm on Relay 3.
3) Program Hach analyzer to output end-of-measurement signal (contact closure) on Relay 4.
4) If remote track & hold option is used with Sample Sequencer, the 4-20 mA REC OUT signal is also connected in series to the track & hold boards. See diagram of recorder connections using remote track & hold output boards.
5) If signal switching output board option is used with Sample Sequencer, the 4-20 mA REC OUT signal is also connected in series to the signal switching output boards. See diagram of recorder connections using signal switching output boards.

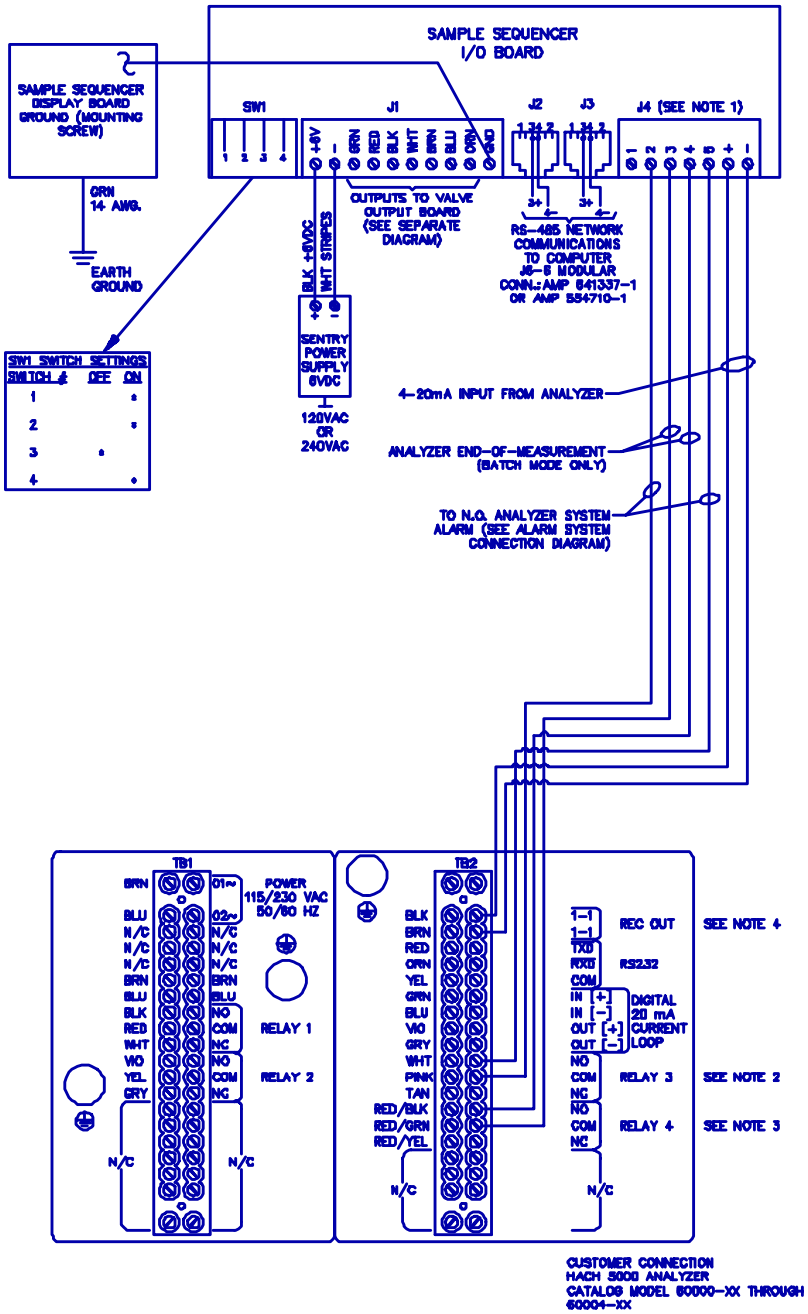


FIGURE D1 - Wiring to Hach Series 5000 Analyzer Models 60000 - 60004

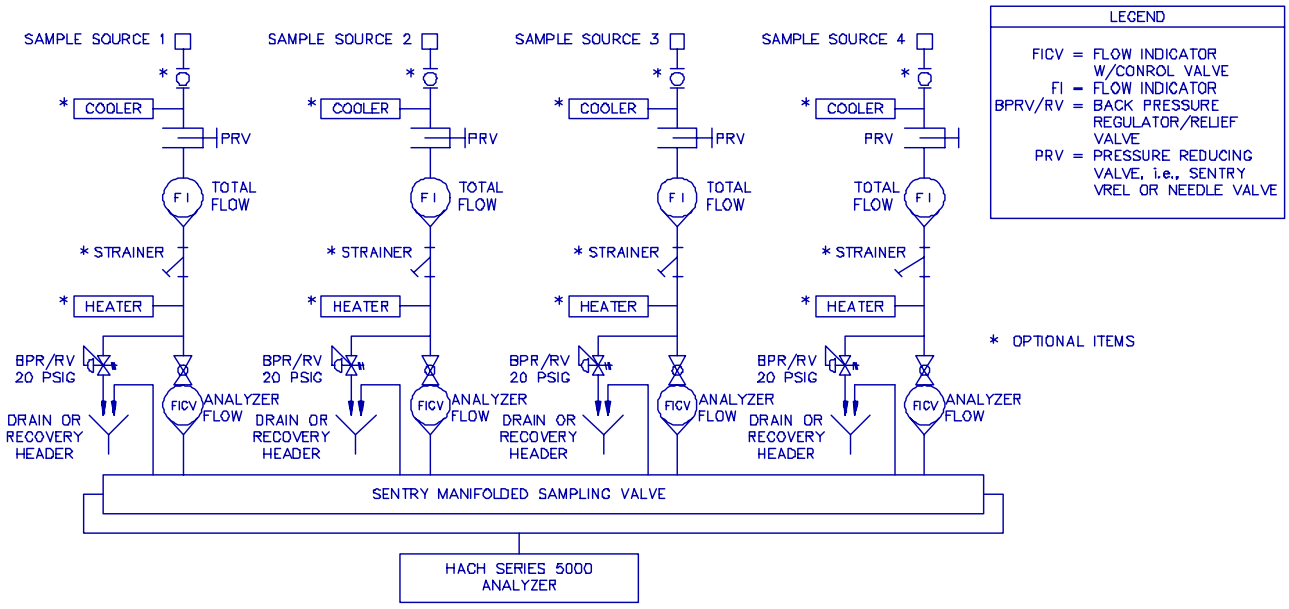


Figure D2 - Recommended Sample Conditioning
for Switching Streams to a Hach 5000 Analyzer

See Hach Drawing No. 30499-00 at end of this manual.

Figure D3 - Transmittal, Sample Sequencer and Manifold Valves - Electrical

See Hach Drawing No. 30499-00 at end of this manual.

Figure D4 - Transmittal, Sample Sequencer and Manifold Valves

Appendix E

Sample Sequencer Basic Electrical Wiring Diagram

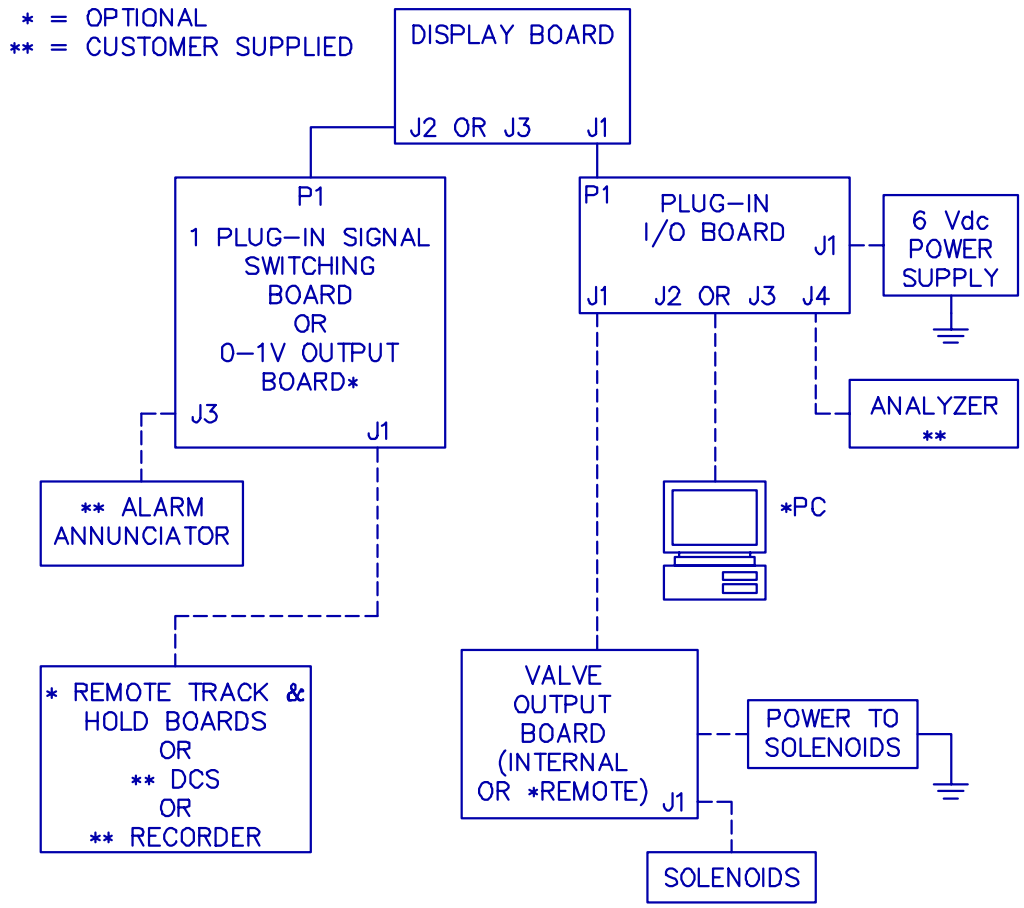


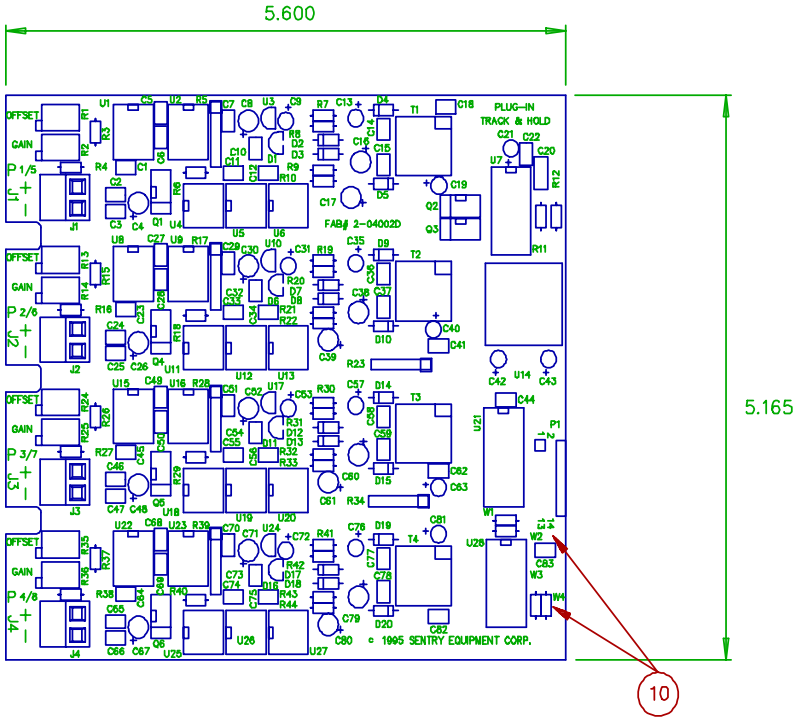
FIGURE E1 - Sample Sequencer Basic Electrical Wiring Diagram

Appendix F

Procedure to Configure Plug-In Track & Hold for Dual Point Output

The Plug-In Track & Hold circuit card plugs into slots 2 and 9 of Sample Sequencer enclosure as optional cards. When the Track & Hold Board is in number 2 slot (left board in Figure 18), it normally provides an analog output from 1 thru 4 points. When the track & hold card is used in number 9 slot (center in Figure 18), it provides an analog output from 5 thru 8 points.

However, after configuring the track & hold circuit card for dual output mode, slot number 2 Track & Hold Board points 1 and 3, and, 2 and 4 will output the same sample point analog value. Slot number 9 Track & Hold Board points 5 and 7, and, 6 and 8 will output the same sample point analog values. Dual outputs may be required in cases when separate signals to a recorder and digital control system (DCS) are necessary.



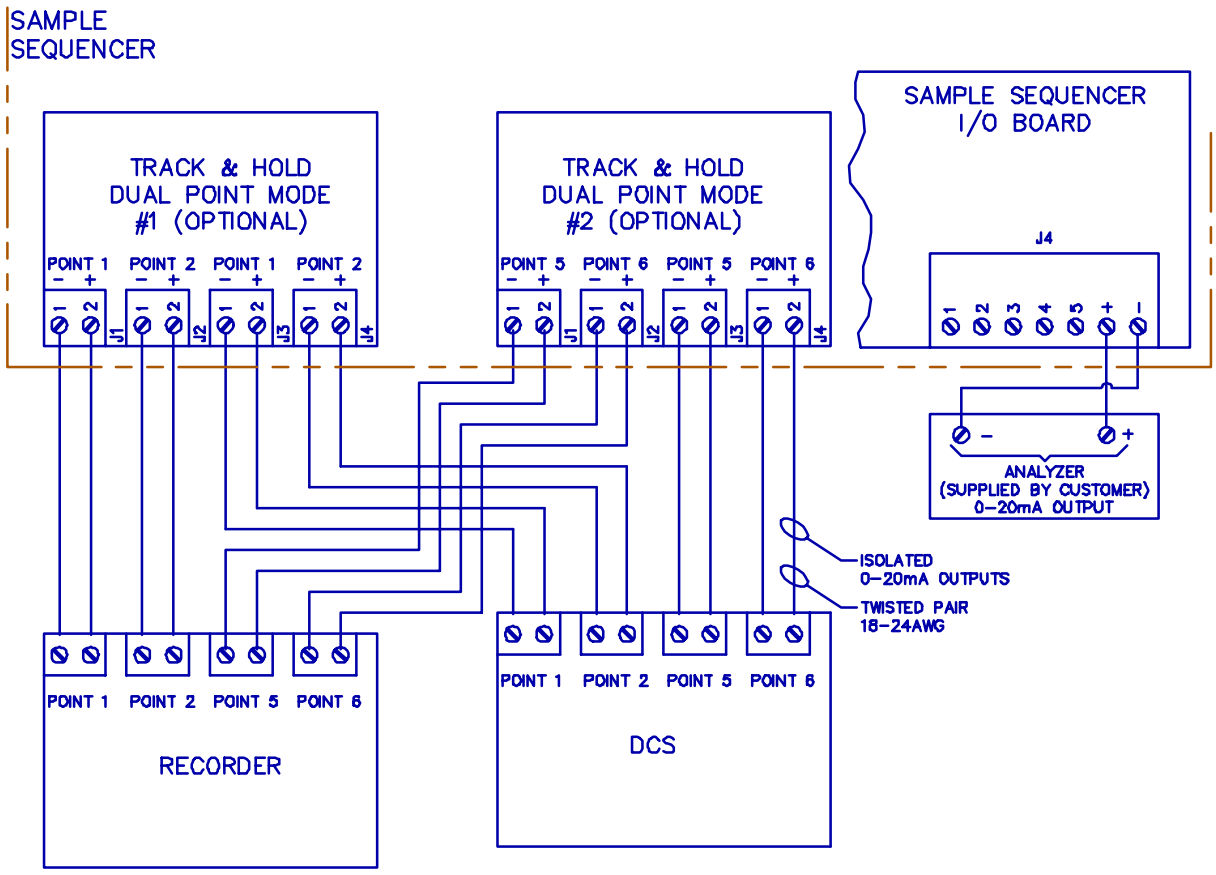
Normal Mode
J3 is Normal point 3/7 mode (W1 removed, W2 installed)
J4 is normal point 4/8 mode (W3 removed, W4 installed)

Dual Point Mode
J3 is dual point 1/5 ,mode (W1 installed, W2 Removed)
J4 is dual point 2/6 mode (W3 installed, W4 removed)

Figure F1 - Component View

Procedure to configure Plug-In Track & Hold Boards for Dual Output

1. Remove zero OHM jumpers W2 and W4.
2. Install zero OHM jumpers W1 and W3.
3. Turn Off Points 3 and 4 at Sample Sequencer front membrane when Plug-In Track & Hold is installed into number 2 slot.
4. Turn Off Points 7 and 8 at sample sequencer front membrane when Plug-In Track & Hold is installed into number 9 slot.
5. You will now have dual outputs for sample points 1, 2, 5 and 6. See Figure F2 for wiring.



Sample Sequencer with dual point plug-in electronic Track & Hold, DCS, Recorder, Analyzer, Configuration.

*In dual point mode:	Labeled Point #3	Provides same analog output as Point #1
	Labeled Point #4	Provides same analog output as Point #2
	Labeled Point #7	Provides same analog output as Point #5
	Labeled Point #8	Provides same analog output as Point #6

Figure F2 - Wiring Diagram - Dual Outputs from Plug-In Track & Hold Board

Appendix G

Retrofitting a Plug-in (Internal) Track & Hold Board in the Field

Please, follow the below procedure if a plug-in (internal) track & hold upgrade kit was purchased to retrofit an existing Sample Sequencer in the field.

The upgrade kit should contain one or two (if ordered) plug-in track & hold boards, one 3 Amp fuse, a new microprocessor and a 3 Amp 6 VDC power supply. If the kit with two boards was received, an enclosure and cable for remote mounting of your existing valve relay board is also included. A new microprocessor is also included.

Procedure

1. Disconnect power.

2. Disconnect wires and remove signal switching board. This board is the left-most board as viewed from rear of the Sample Sequencer (See Figure 17). You may store this board because it is not used in conjunction with the plug-in track & hold board feature.

3. If two plug-in track & hold boards must be installed, disconnect wires and remove the valve relay board (located in the center as viewed from rear). Install this board in the remote enclosure provided with your track & hold retrofit kit. The valve board must be located remote from Sequencer in order to install two plug-in track & hold boards.

4. At the I/O board (located on far right as viewed from rear), disconnect the power supply wires from +6V and - terminals at J1 of I/O board.

5. Connect the new power supply (supplied in your retrofit kit) to the I/O board.

6. Replace the fuse (F1) on I/O board with the 3 Amp fuse included in your retrofit kit.

7. Inspect the date code on existing microprocessor (U3). If it is older than 8/95, replace it with the new chip included with your upgrade kit.

8. Turn DIP switch SW1-2 on I/O board Off .

9. Install your new plug-in track & hold board in the far left slot for sample points 1-4. If you purchased two plug-in track & hold boards, install the second board (Points 5-8) in the center slot. Refer to Figure 18.

10. Connect output wiring to recorder or DCS from Plug-In Track & Hold Boards according to Figure 23.

11. Apply power to the sample Sequencer by plugging in your new 6 VDC power supply.

12. The plug-in track & hold board will output and hold the respective 0-20 mA or 4-20 mA signal after the respective point has gone through one Dwell time period.

Trouble-shooting: If the Sample Sequencer display doesn't illuminate, check the fuse (F1) on the I/O board. If shorted out, replace the with the 3 Amp fuse included in retrofit kit. (See step 6 above.) If the display still doesn't light, verify you are using the new 3 Amp power supply included in your retrofit kit. (See step 5, above.) Using a meter, one should measure a minimum 6 VDC across terminals +6 and - on J1 of the I/O board. The old power supply is inadequate when using plug-in track & hold.

13. Note: Your plug-in track & hold board has a total of four independent outputs and is factory-calibrated.

    See Appendix F if you desire to reconfigure your board to produce two independent outputs per point with a maximum two points per plug-in track & hold board.

Appendix H

Procedure to Configure Remote Track & Hold Card for Voltage Input.

The Remote Track & Hold Card (7-00844A) - assembly 7-00839A- is factory shipped to input a 0-20 or 4-20 analog value in milliampere form. The following procedures configure the circuit board (see Figure H1) to operate with a voltage input of 0-1VDC, 0-5 VDC, or 0-10 VDC.

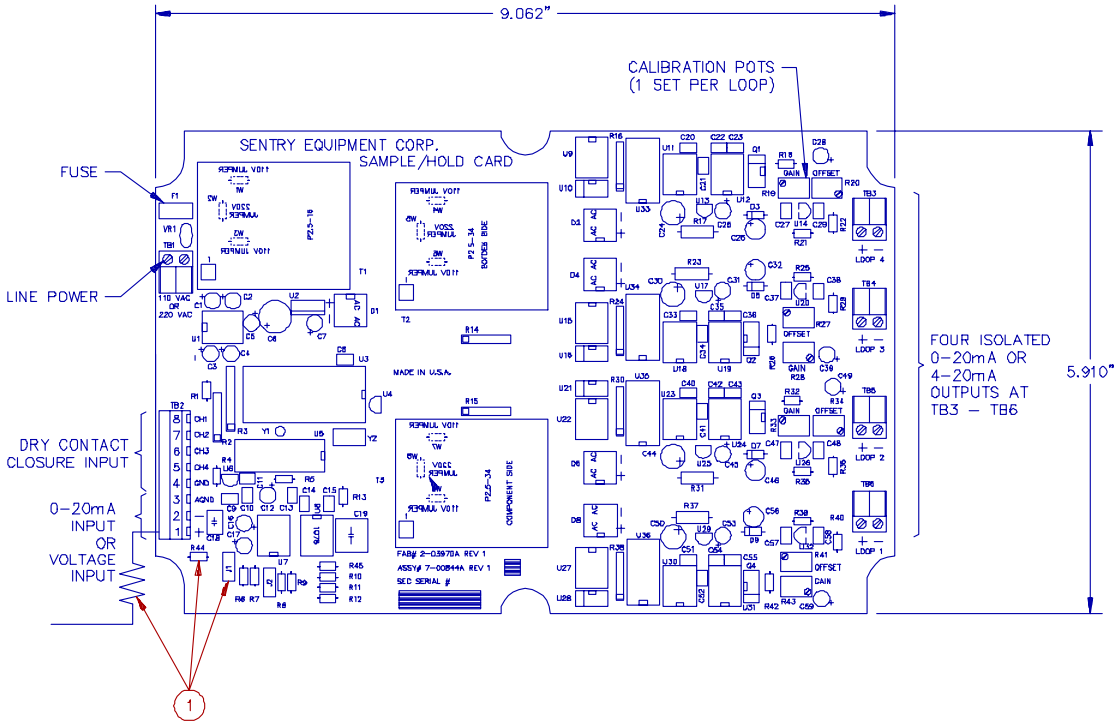


Figure H1 - Configuring Remote Track & Hold Board for Voltage Input

Notes:
mA Configuration (Default Assembly)
R44=Zero ohm jumper installed.
J1=No component installed.

0-1 VDC Configuration
1. Remove Zero ohm jumper R44.
2. Install a 37 ohm resistor[1] at J1.

0-5 VDC Configuration
1. Remove Zero ohm jumper R44.
2. Install a 237 ohm resistor[1] at J1.

0-10 VDC Configuration (Use this config. with a Floating (isolated) or -10VDC Power Supply[2])
1. Remove Zero ohm jumper R44.
2. Install a 487 ohm resistor[1] at J1.
3. Tie the "+" to "AGND" on TB2 with a jumper wire.

0-10 VDC Configuration (Use this configuration with a +10VDC Power Supply.[2]
1. Install a 487 ohm resistor[1] to "+" on TB2. Connect the Vin positive wire to the resistor. Sentry Equipment recommends soldering the positive wire to the resistor, and covering the solder connection with heat shrink tubing.

[1] 1/4 Watt, 1% Metal Film Resistor

[2] To determine the power supply type, use an Ohm Meter and measure the resistance from the positive terminal to ground or negative terminal to ground. If the resistance is <100 ohms between the positive terminal and ground, it's a - 10 vdc power supply. If the resistance is <100 ohms between the negative terminal and ground, it's a +10 vdc power supply. If the resistance is >100 ohms in either case, it's a floating 10 vdc input.

DWG. NO. 30499-00 | SHT 3 | REV A

REVISIONS

REV	DESCRIPTION	DATE	APPROVED

POWER SUPPLIES

6 V

12 V

BLACK

WHITE STRIPE

\+ TYP -

POWER SUPPLY CABLE

BACK VIEW OF SAMPLE SEQUENCER WITH INTERNAL 8 CHANNEL TRACK AND HOLD BOARDS INSTALLED. REAR COVER REMOVED.

REMOTE VALVE BOARD

NOTE: ILLUSTRATION SHOWS SEQUENCER WITH 8 CHANNEL INTERNAL TRACK AND HOLD WITH REMOTE VALVE BOARD. THE 4 CHANNEL MODEL WILL HAVE THE BOARD MOUNTED INSIDE THE SEQUENCER.

TB1

TB2

TERMINAL LAYOUT S5000 ANALYZER

OPTIONAL CUSTOMER SUPPLIED MULTIPOINT RECORDER OR DATA AQUISITION EQUIPMENT BACK VIEW

R1 R2 R3 R4

HACH SERIES 5000 ANALYZER BACK VIEW

TYPICAL HOOKUP EACH VALVE

MANIFOLD VALVE DETAIL

QUANTITY PER UNIT/SYS	DESCRIPTION	SEL NOTE	KIT NO.	PART NO.	ITEM
	PARTS LIST				

FOR GENERAL REQUIREMENTS SEE HACH STANDARDS DRAWINGS AND PRACTICES.

DO NOT SCALE THIS DWG.

MATL

NOTICE – HACH Company claims proprietary rights in the information disclosed on this drawing. It is issued in confidence for engineering information only and may not, in whole or in part, be used to manufacture anything, whether or not shown hereon, or disclosed to anyone without written permission from Hach Company.

DWN	2-29-96	DCH	
CHK			
ENGR	P. MCGIVNEY	JH	

HACH COMPANY LOVELAND, COLORADO - AMES, IOWA

TITLE: TRANSMITTAL, SAMPLE SEQUENCER AND MANIFOLD VALVES-ELECTRICAL

SIZE D | DWG. NO. 30499-00 | REV A

SCALE 3/4 | WT | SHT 3 OF 3

NEXT ASSY | USED ON

SHT | SIZE | REV

REVISION STATUS OF SHEETS

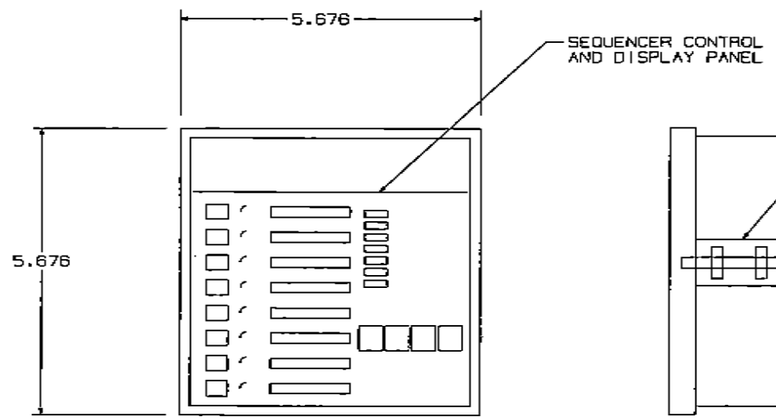
FIGURE D3 - TRANSMITTAL, SAMPLE SEQUENCER AND MANIFOLD VALVES - ELECTRICAL

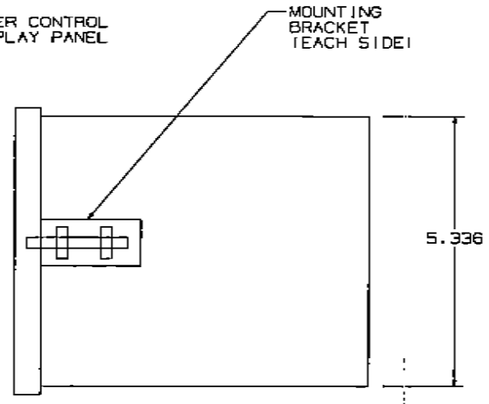
NOTES:

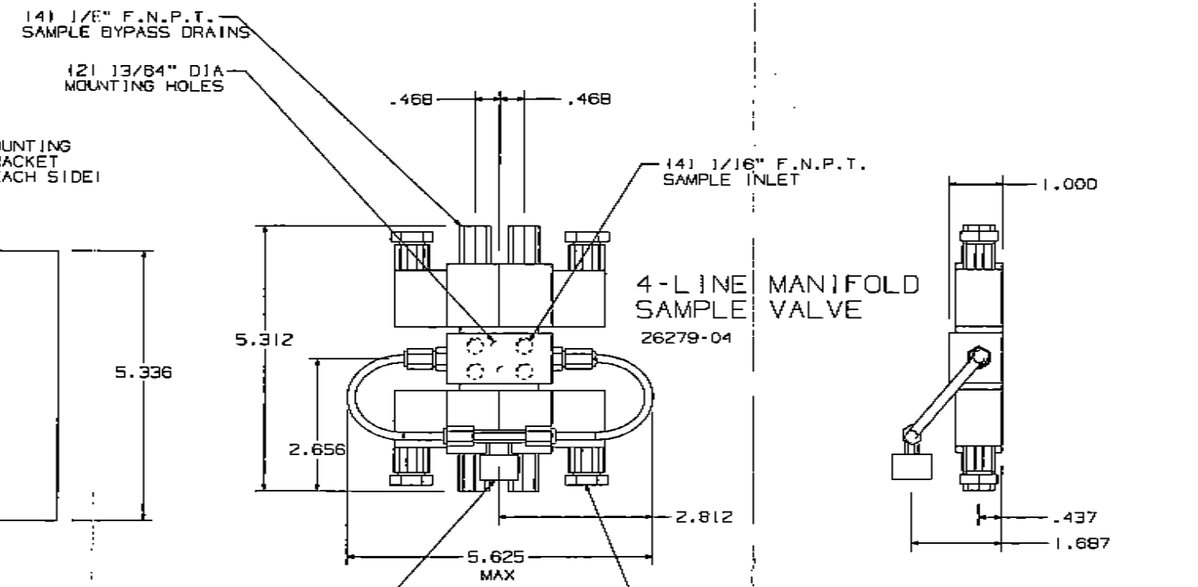
1. ALL MANIFOLD DIMENSIONS ARE TYPICAL. 8 CHANNEL MANIFOLD IS TWO FOUR CHANNEL MANIFOLDS CONNECTED TOGETHER FOR SAMPLE OUTPUT.

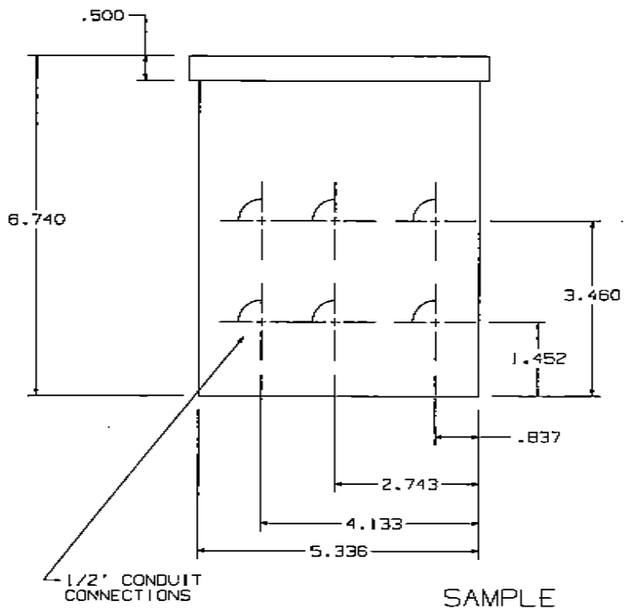
DWG. NO.	30499-00	SHT 1	REV A

REV	DESCRIPTION	DATE	APPROVED
A	DRAWING RELEASE	2-28-98	GS JH

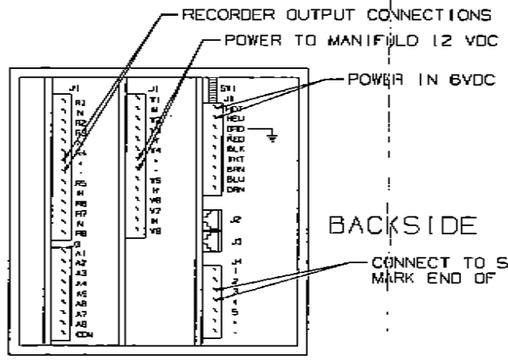


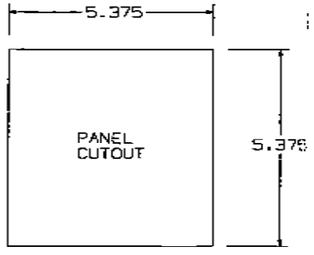


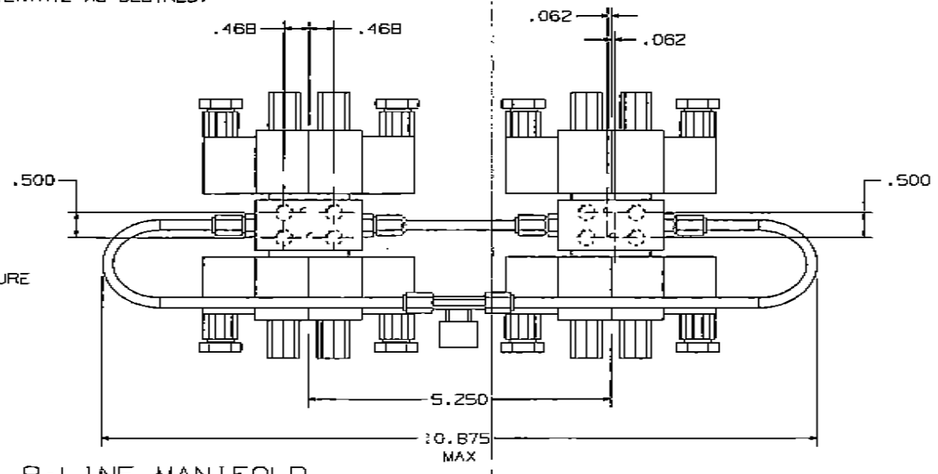




SAMPLE SEQUENCER
PART NO. 26277-00







8-LINE MANIFOLD SAMPLE VALVE
26279-08

PARTS LIST

QUANTITY PER SYSTEM	DESCRIPTION	REF DES	PART NO.	ITEM

FOR MATERIAL REQUIREMENTS SEE HACH STANDARDS. CAPACITORS ARE IN MICROFARADS.

DO NOT SCALE THIS DRWG.

MATL.

DRN	2-28-98	OCH
CHK		
ENGR	9 JH/KSEE	JH
APP		

HACH COMPANY
LOVELAND, COLORADO – AMES, IOWA

TITLE: TRANSMITTAL, SAMPLE SEQUENCER AND MANIFOLD VALVES

SIZE	DWG. NO.	REV
D	30499-00	A

NEXT ASSY	USED ON	SCALE 3/4	WT	SHT 1 OF 2

REVISION STATUS OF SHEETS	SHT	DATE	REV

FIGURE D4 - TRANSMITTAL, SAMPLE SEQUENCER AND MANIFOLD VALVES